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Technical Report

STATISTICAL ANALYSIS OF TERRAIN AND WATER BACKGROUNDS IN THE VICINITY OF PORT HUENEME, CALIFORNIA

ANTHONY J. LaROCCA
Infrared and Optics Division

APRIL 1979

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ENVIRONMENTAL
RESEARCH INSTITUTE OF MICHIGAN
FORMERLY WILLOW RUN LABORATORIES, THE UNIVERSITY OF MICHIGAN
BOX 8618 • ANN ARBOR • MICHIGAN 48107

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Data from infrared imagery on various terrain and water backgrounds have been collected by the Environmental Research Institute of Michigan and have been analyzed to present their statistical features. This work is being funded by the Optical Signatures Program to Support Navy Requirements. This report describes some of the characteristics in the form of histograms, cont

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micrometers

Abstract (Cont.)

Cont ellipse "pictures", and power spectra for the following infrared spectral bands: 2.0-2.6, 3.0-4.2, 4.5-5.5, and 9.0-11.4 μm. Special areas were chosen to demonstrate the variation in results with the selection of different backgrounds.

SUMMARY

The work described herein was funded by the Optical Signatures Program to Support Navy Requirements. Data from infrared (IR) imagery on various terrain and water backgrounds in the vicinity of Port Hueneme, CA have been collected by the Environmental Research Institute of Michigan and have been analyzed to present their statistical features. The data were collected by the ERIM M-7 scanner, a multispectral scanner which operates in several wavelength bands in the visible and infrared portions of the E-M spectrum. The imagery was collected with the scanner looking both downward and in a direction elevated 55 degrees with respect to the nadir.

The various areas analyzed in this report are depicted in greymaps shown in the body of the report. The characteristics of the IR imagery and of the flight conditions are described in detail. The scanner footprint in the downward looking case is almost 4.4 ft x 4.4 ft, and in the slant case it is about 4.4 ft x 7.6 ft. The statistics calculated have been presented in figures and tables in the body of the report as histograms, spectral correlations, ellipses, and power spectra.

Histograms of probability-of-occurrence of the signal values are presented in terms of spectral radiance for the 2.0-2.6 μm wavelength band, and in terms of apparent temperature in the 3.0-4.2 μm, 4.5-5.5 μm, and 9.0-11.4 μm wavelength bands. The relationship between the temperature and radiance statistics of the three thermal bands is discussed in the text.

Spectral correlations are presented to show relationships between the signals of the various channels. These are given along with means and standard deviations for the different bands and the various scenes.

A special analysis was made of a small area consisting of strong sun glint. These statistics are presented in a section separate from the ones describing the land areas.

Ellipse representations of scene features are presented, depicting area sizes which occur above (or below) given threshold levels. The basis for the formation of ellipses is described in an earlier report [1]. Each ellipse represents certain features in the scene in area and general orientation, except that the area is specialized to a simple geometric form.

Power spectra of each of the scenes are presented for comparing results of different spectral regions.

[1] R. Spellicy, J. Beard, and J. R. Maxwell, Statistical Analysis of Terrain Background Measurements Data, Report 120500-12-F, ERIM, March 1977.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the invaluable assistance of Ms. Abby Liskow in performing the extensive computer operations necessary for the successful completion of the analyses.

Under the supervision of Mr. Stephen Stewart, data were collected on the flight by instrumentation specialists Mr. Jimmie Ladd and Mr. William Juodawlkis. Mr. Stewart contributed Appendix B of the report.

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1
INTRODUCTION

As part of a program to derive statistical information on the electromagnetic (EM), visible and IR characteristics of various terrain backgrounds, we have analyzed imagery of selected areas in the vicinity of Port Hueneme, CA, an aerial photo of which is shown in Figure 1. The actual imagery analyzed are shown in Figures 2 (HUME1) and 3 (HUME2). The imagery from which the analyses were made were collected with the ERIM M-7 scanner, described in detail in Reference 1. Briefly, the system is a multispectral scanner operating in several bands in the visible and IR portions of the E-M spectrum. The background data, along with signals from several calibrating sources, are digitally recorded on a high-density digital tape and converted to a computer-compatible tape from which the analyses are made.

We have concentrated on specific areas requested by the sponsor and indicated in the greymaps: *Area #1* in *Figure* 4, *Area #2 in Figures* 4 and 5, and Area G in Figure 5. We have analyzed also a large part of the total area in each of the two runs designated as HUME1 and HUME2. The total areas comprise a large part of the land mass and some of the open water. The data were collected in the following wavelength bands: 2.0-2.6, 3.0-4.2, 4.5-5.5, and 9.0-11.4 μm. Pertinent information on these data is given in Table 1.

The analyses for this effort take the following forms: histograms, spectral correlations, ellipses, and power spectra.

2
HISTOGRAMS

After the imagery are calibrated and computer-processed to achieve line-by-line contiguity, the data are stored on magnetic tape in such a way that individual pixel data can be analyzed. For a given run, the pixel values are stored in data bins and counted for the purpose of

[1] R. Spellicy, J. Beard, and J. R. Maxwell, Statistical Analysis of Terrain Background Measurements Data, Report 120500-12-F, ERIM, March 1977.

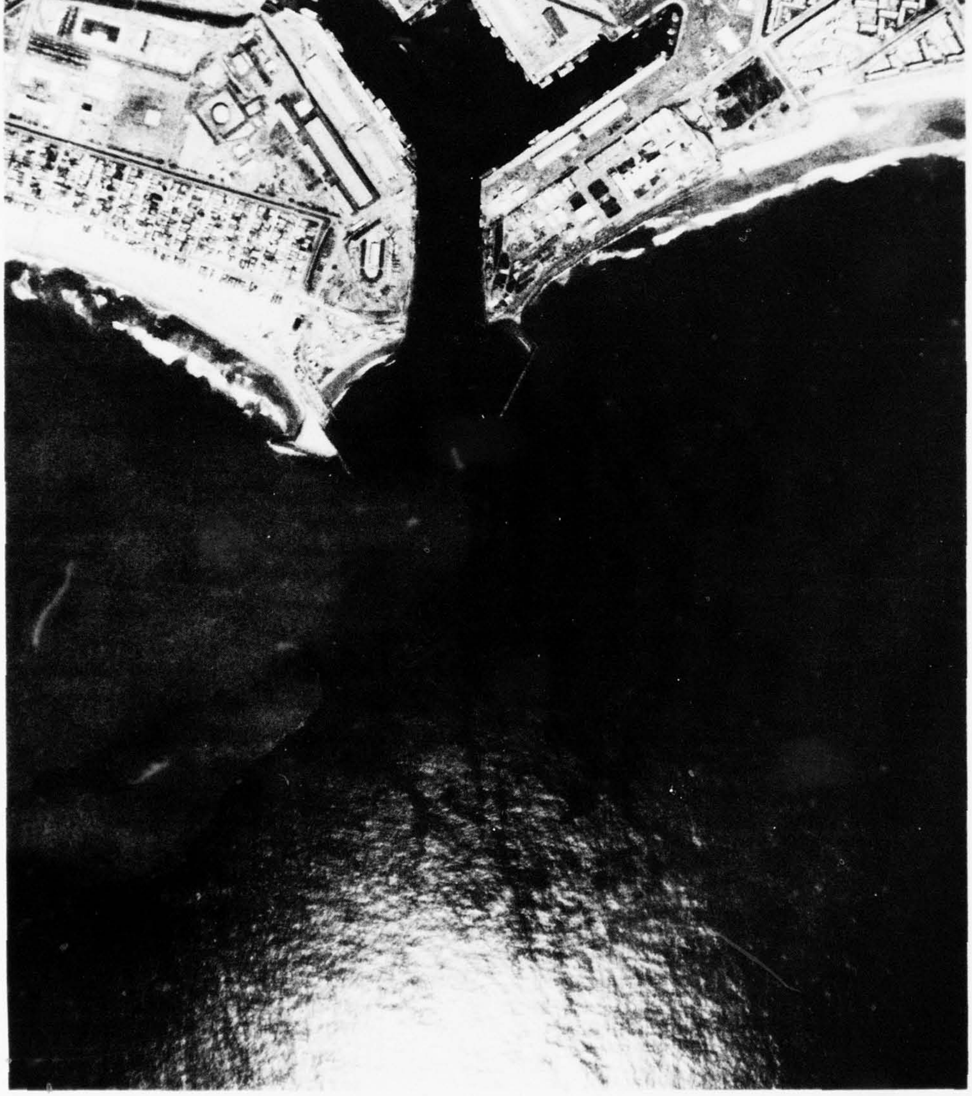


FIGURE 1. AERIAL PHOTOGRAPH - PORT HUENEME

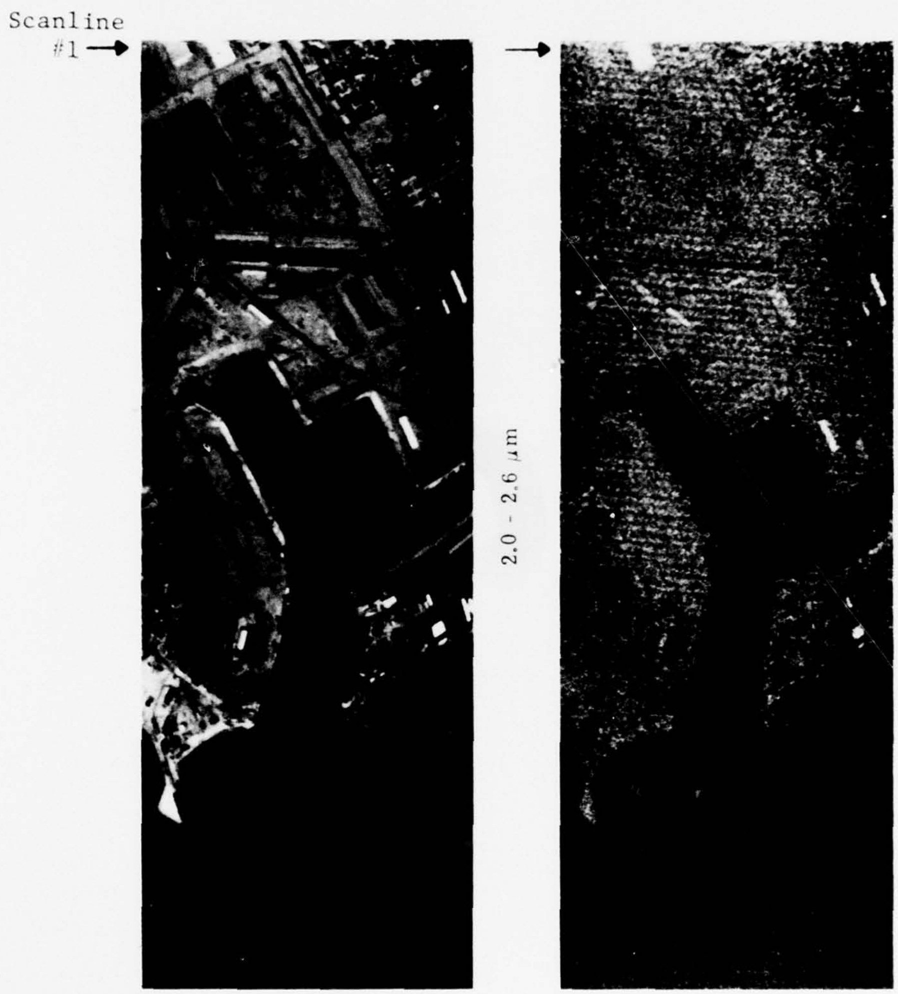
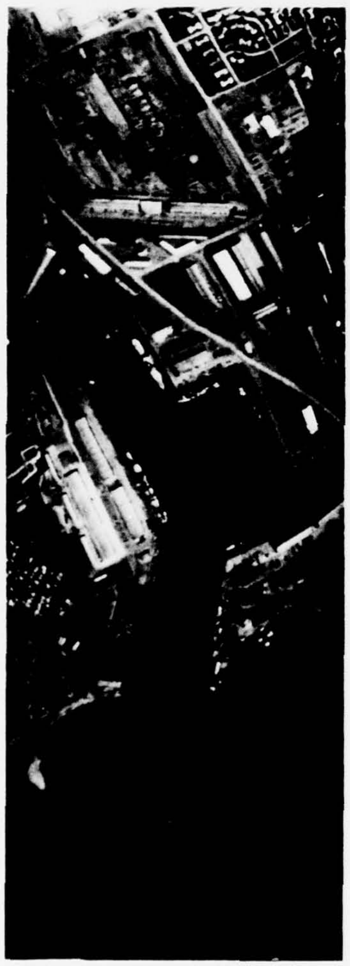
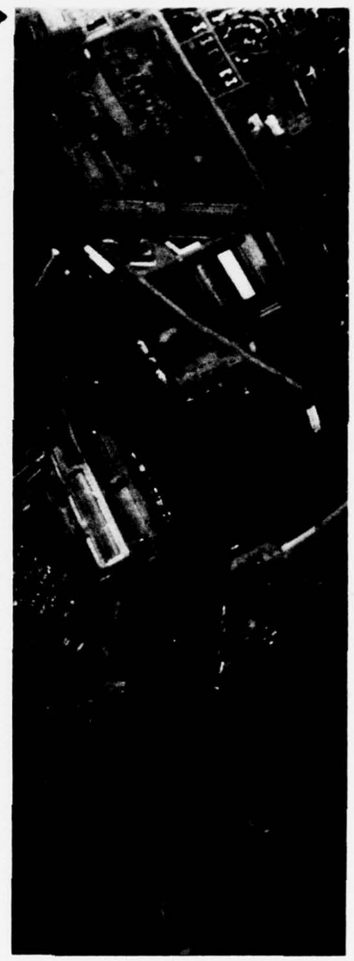


FIGURE 2(a). PORT HUENEME IMAGERY - 90° DEPRESSION (HUME1)

Scanline
#1



4.5 - 5.5 μm



9.0 - 11.4 μm

FIGURE 2(b). PORT HUENEME IMAGERY - 90° DEPRESSION (HUME1)

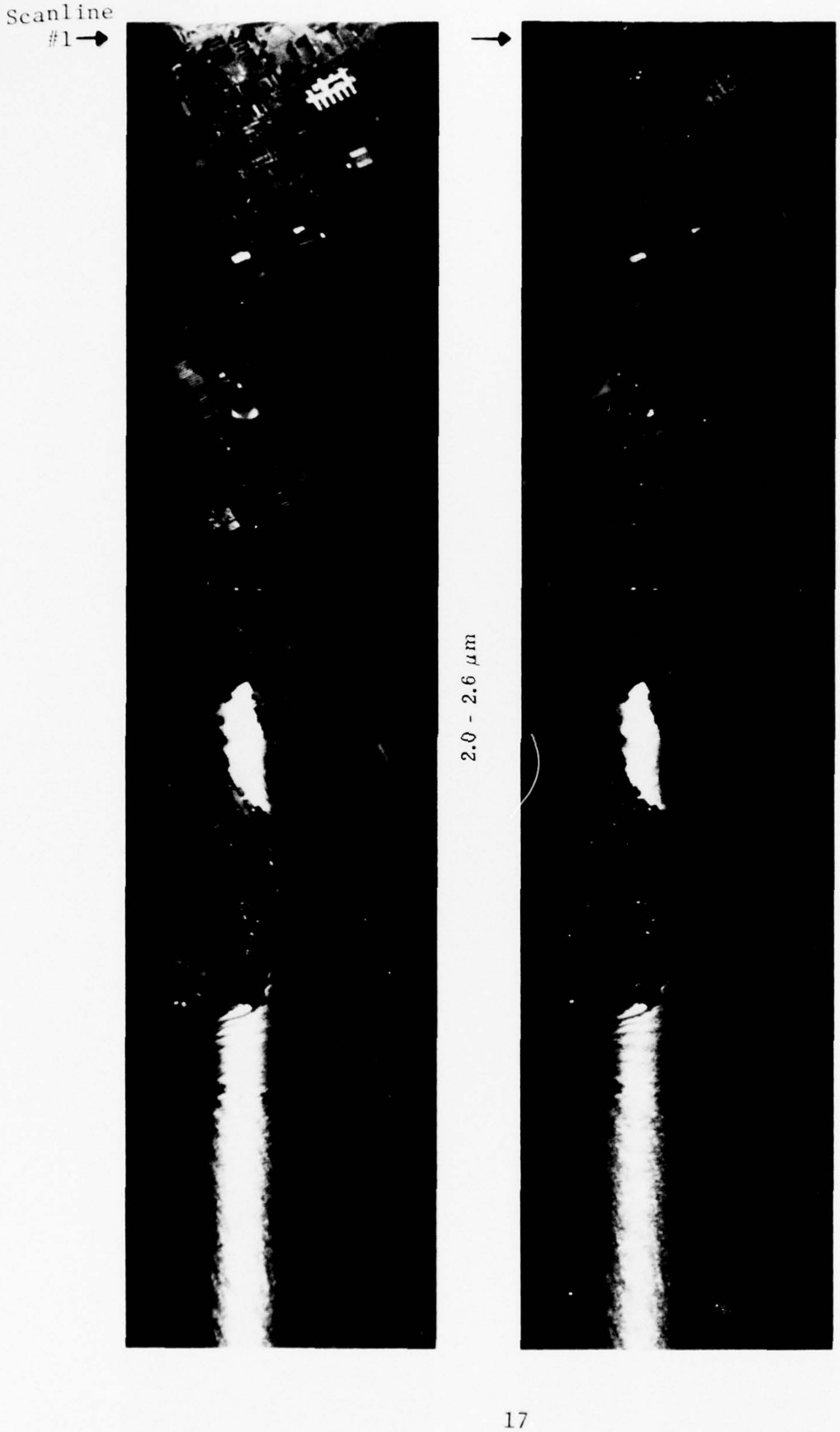


FIGURE 3(a). PORT HUENEME IMAGERY - 35° DEPRESSION (HUME2)

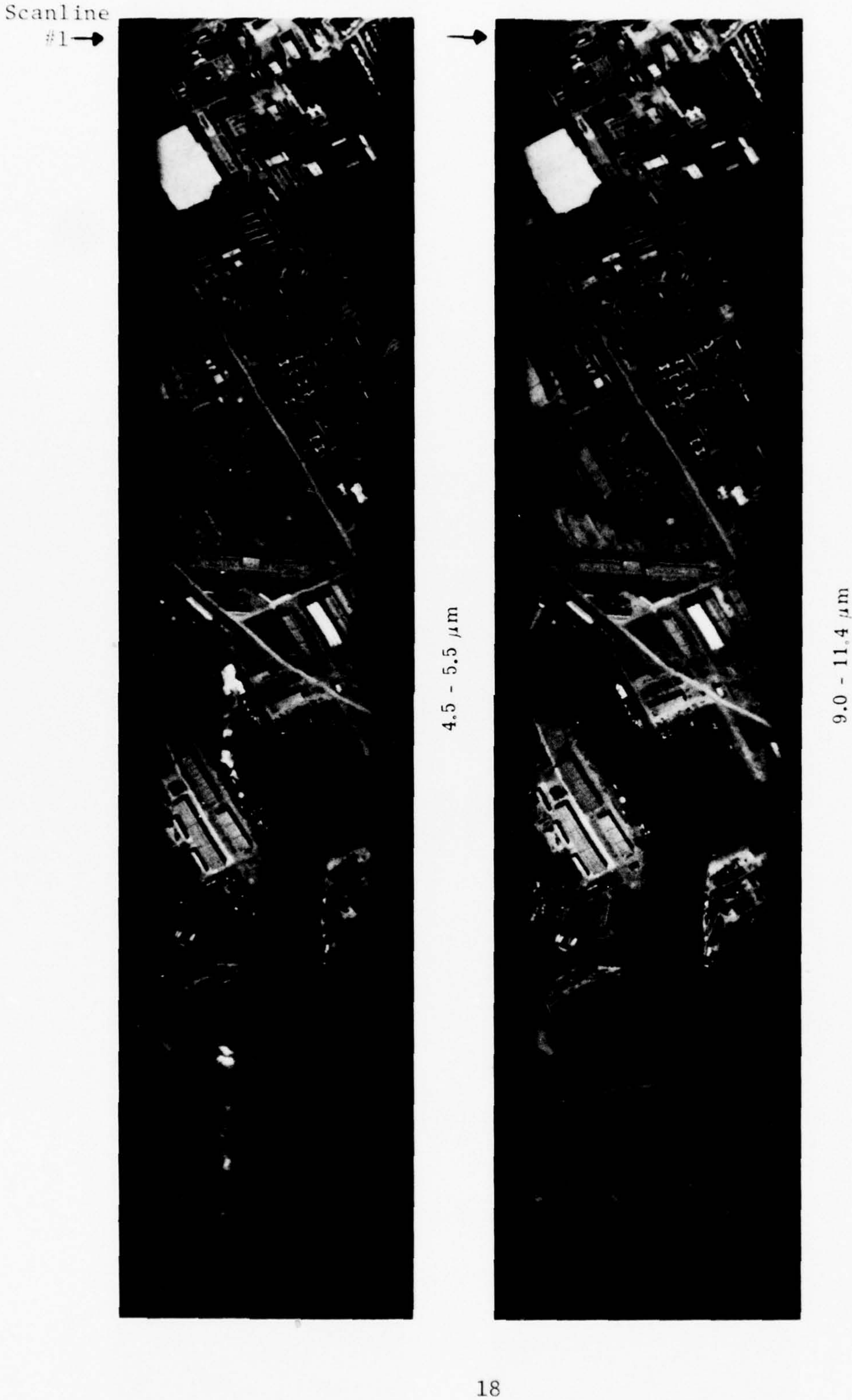


FIGURE 3(b). PORT HUENEME IMAGERY - 35° DEPRESSION (HUME2)

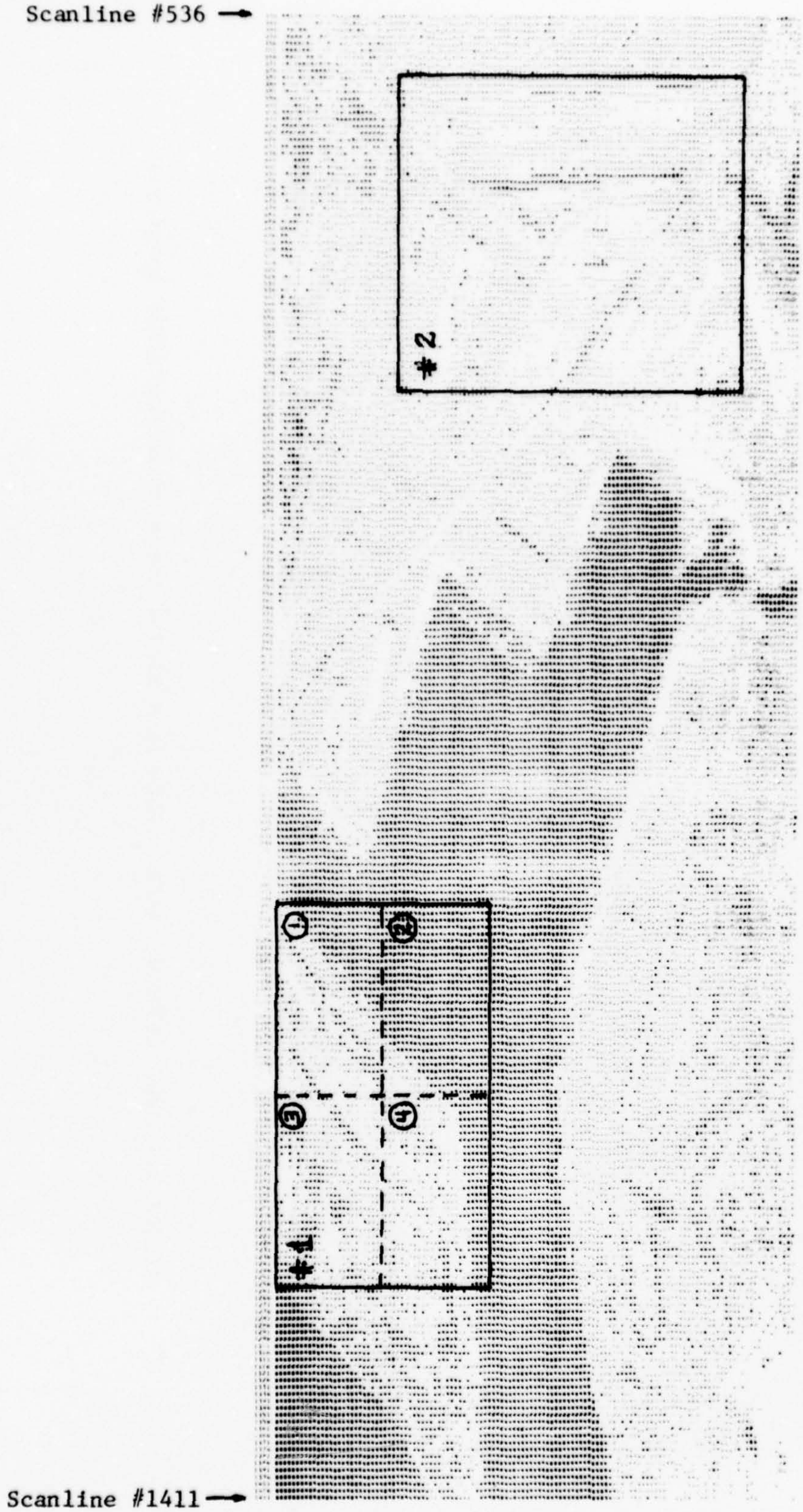


FIGURE 4. HUME1 GREYMAP (Note: This is a mirror image of photographic imagery.)

Scanline #571 →

Scanline #1616 →

FIGURE 5. HUME2 GREYMAP (Note: This is a mirror image of photographic imagery.)

TABLE 1

PERTINENT INFORMATION ABOUT PORT HUENEME DATA

HUME1 Data

Wavelength Bands:

2.0-2.6 μm, 3.0-4.2 μm, 4.5-5.5 μm, 9.0-11.4 μm

IFOV: 2.5 mrad

Altitude: 1750 ft Depression Angle: 90°

Time: 1215 hrs Flight Direction: West

Ground Speed: 202 ft-sec^{-1}

Area Covered (Approx.):

#1) 1300 ft long x 1200 ft wide

#2) 900 ft long x 1850 ft wide

Total) 6350 ft long x 2800 ft wide

HUME2 Data

Wavelength Bands:

2.0-2.6 μm, 3.0-4.2 μm, 4.5-5.5 μm, 9.0-11.4 μm

IFOV: 2.5 mrad

Altitude: 1000 ft Depression Angle: 35°

Time: 1420 hrs Flight Direction: West

Ground Speed: 202 ft-sec^{-1}

Area Covered (Approx.):

#2) 900 ft long x 1850 ft wide (same terrain as #2 in HUME1)

G) 1800 ft long x 900 ft wide (sun glint on water)

Total) 10,000 ft long x 2700 ft wide

creating histograms, and the mean values and standard deviations are computed. From these results, the temperature-related histograms are plotted. In the 2.0-2.6 μm band, the histograms are plotted in terms of spectral radiance. In the other spectral regions, they are plotted in terms of temperature. Histograms for the HUME1 and HUME2 runs are shown respectively in Figures 6 through 8, and in Figures 9 and 10. The curve defined by the circles in each figure is a plot of the Gaussian distribution corresponding to the same mean and standard deviation as for the actual data. The circles are separated by 1/2 σ (σ=standard deviation).

Because of the sun's influence, the data tend to run off the scale for the short wavelength regions. However, if the scale of the radiance histograms (i.e., 2.0-2.6 μm) were extended beyond that in the figures one would find that the pile-up of the data at the right edge does not necessarily indicate saturation. Nor is there necessarily a pile-up at the left edge of the radiance plots. The implied drop-off toward negative radiances simply means that the dark level in the calibration is difficult to choose accurately.

The 2.0-2.6 μm histograms are plotted in terms of spectral radiance inasmuch as a temperature plot would be meaningless, since the sun's influence is so great in this spectral region. We could have analyzed all of the spectral regions in terms of radiance, but reducing the values to equivalent temperature values makes intercomparison of data easier. In fact, in Reference 2, we did reduce the results in the thermal regions in terms of both temperature and radiance, and found that, within less than a 10% error, the radiance statistics can be deduced directly* from the temperature statistics through the Planck function. In view of this, we therefore omitted the radiance statistics for the thermal spectral region.

[2] A. J. LaRocca and J. R. Maxwell, Statistical Analysis of Terrain Data, Report 132300-2-F, ERIM, February 1979.

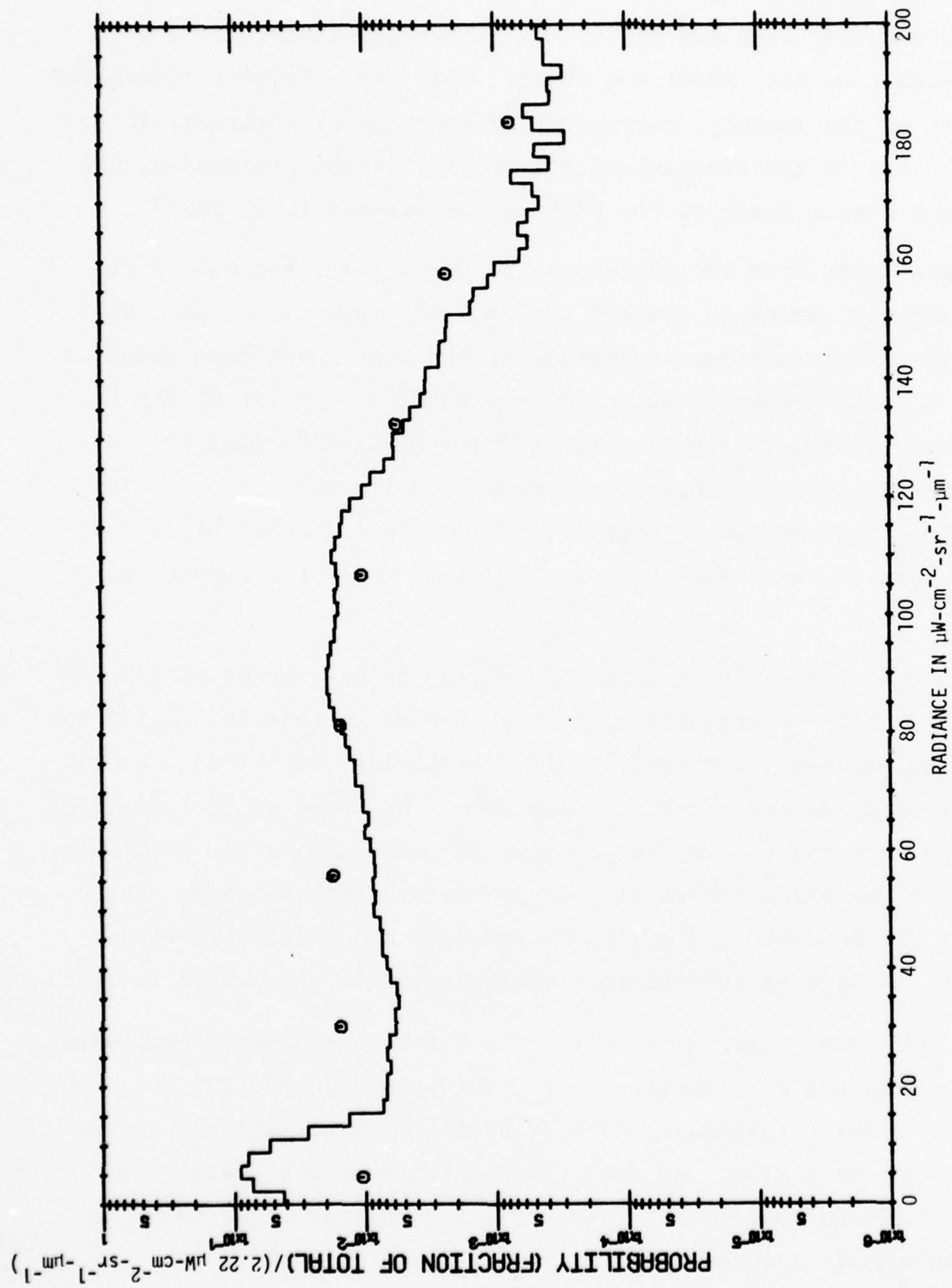
* Strictly speaking, because of the non-linearity of the Planck equation, we should not expect to derive radiance statistics from temperature statistics through the Planck equation. However, the temperature range of values is sufficiently small to allow this to be done without incurring a large error.

Histograms are produced in this report for the areas indicated in Table 1 (the sun glint #G is discussed below). The greymaps of Figures 4 and 5 were obtained from the digitized, calibrated imagery in the 2.0-2.6 μm band from both HUME1 and HUME2. They are helpful in identifying what part of the imagery, corresponding to areas of interest, is to be analyzed. Due to the reversal of the imagery in the processing, the greymaps are a mirror image of the pictures in Figures 1, 2, and 3.

One should note from the imagery of Figure 3 that, because of the angle at which the sensor is pointed for the 35° depression cases, vignetting causes an attenuation of signals on the edge. For that reason we have tried to take care to avoid these regions in certain of the analyses. Note also from the imagery of Figures 2 and 3, that the 3.0-4.2 μm band introduced noise into the data which makes the results subject to greater error of interpretation than in the other bands. Some of the data of this band have been excluded from this report as unusable.

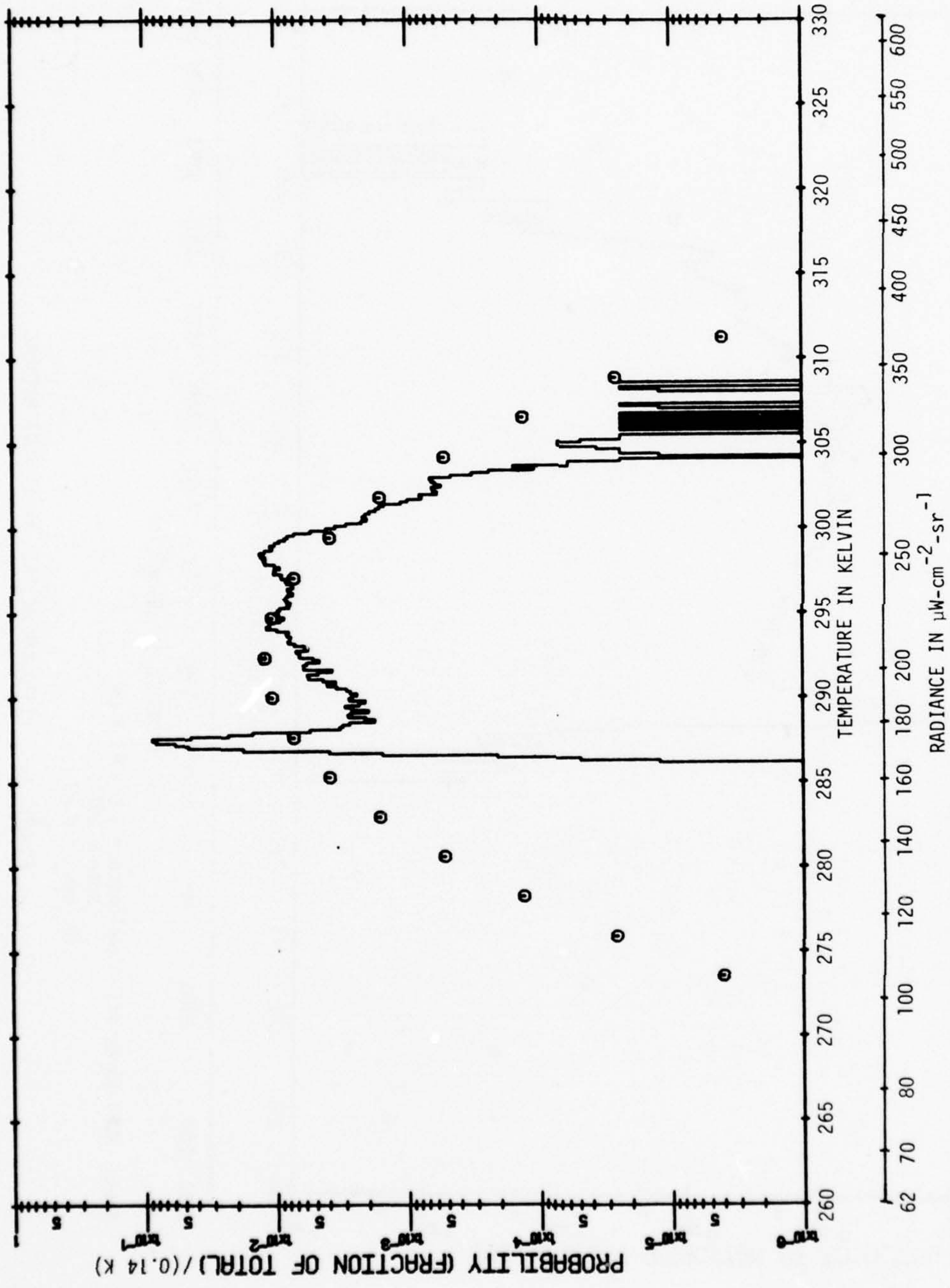
It is particularly interesting to note in the histograms of Figures 6 through 10 that the distributions in the thermal regions at 4.5-5.5 and 9.0-11.4 μm do not agree very well. The distribution at 9.0-11.4 μm extends well beyond that of the 4.5-5.5 μm band. We found no precedent for this behavior in earlier data, and decided to hand-check a few points to make sure that computing errors did not creep into the analysis. See Appendix B. The hand-checked points agreed with those obtained with the computer, so we have assumed that the behavior of the curves is real.

We are not unduly alarmed at these results because the temperatures shown on the abscissa are apparent; i.e., they are deduced from the actual radiance values, assumed to be originating from a blackbody in the respective spectral region. As such, therefore, they are subject to variations in the emissivities of the radiating surfaces, and to variations in atmospheric transmittance.



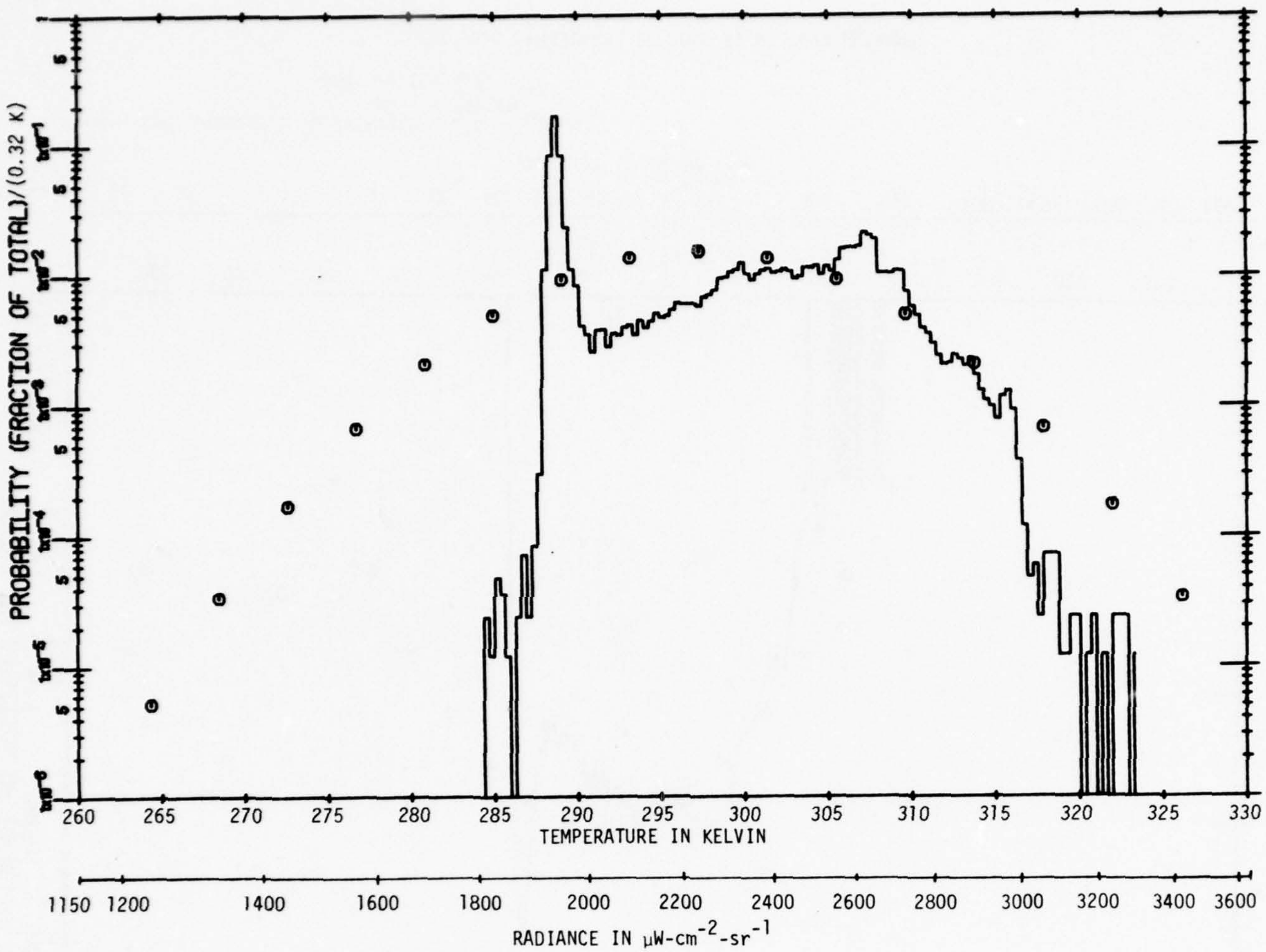
Area: HUM1 (Area #1) Wavelength = 2.0 - 2.6 μm
Mean = 55.79
Std. Dev. = 51.08

FIGURE 6a. HISTOGRAM OF AREA #1 AT PORT HUENEME



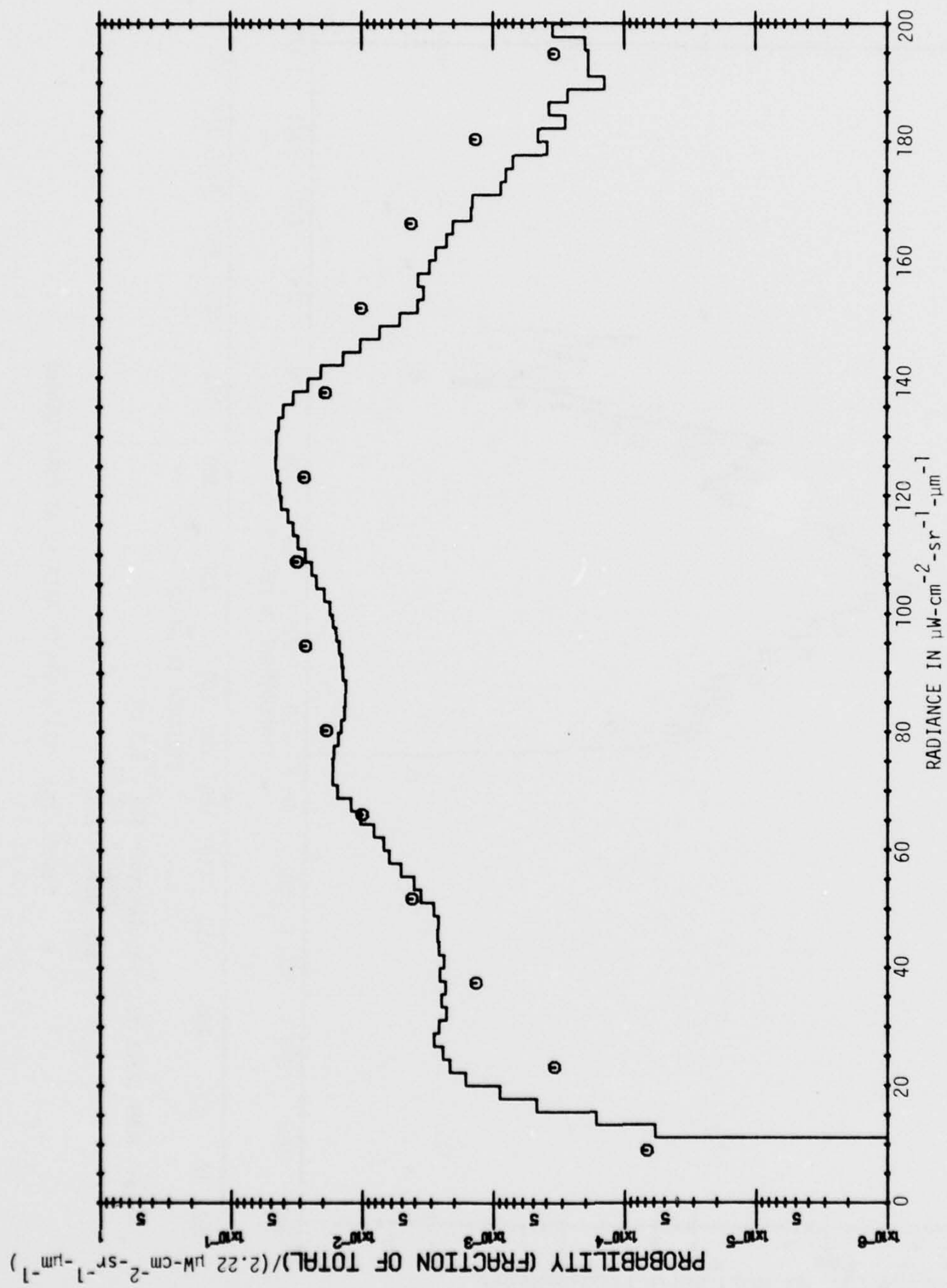
Area: HUM1 (Area #1) Wavelength = 4.5 - 5.5 µm
Mean = 292.40
Std. Dev. = 4.71

FIGURE 6b. HISTOGRAM OF AREA #1 AT PORT HUENEME



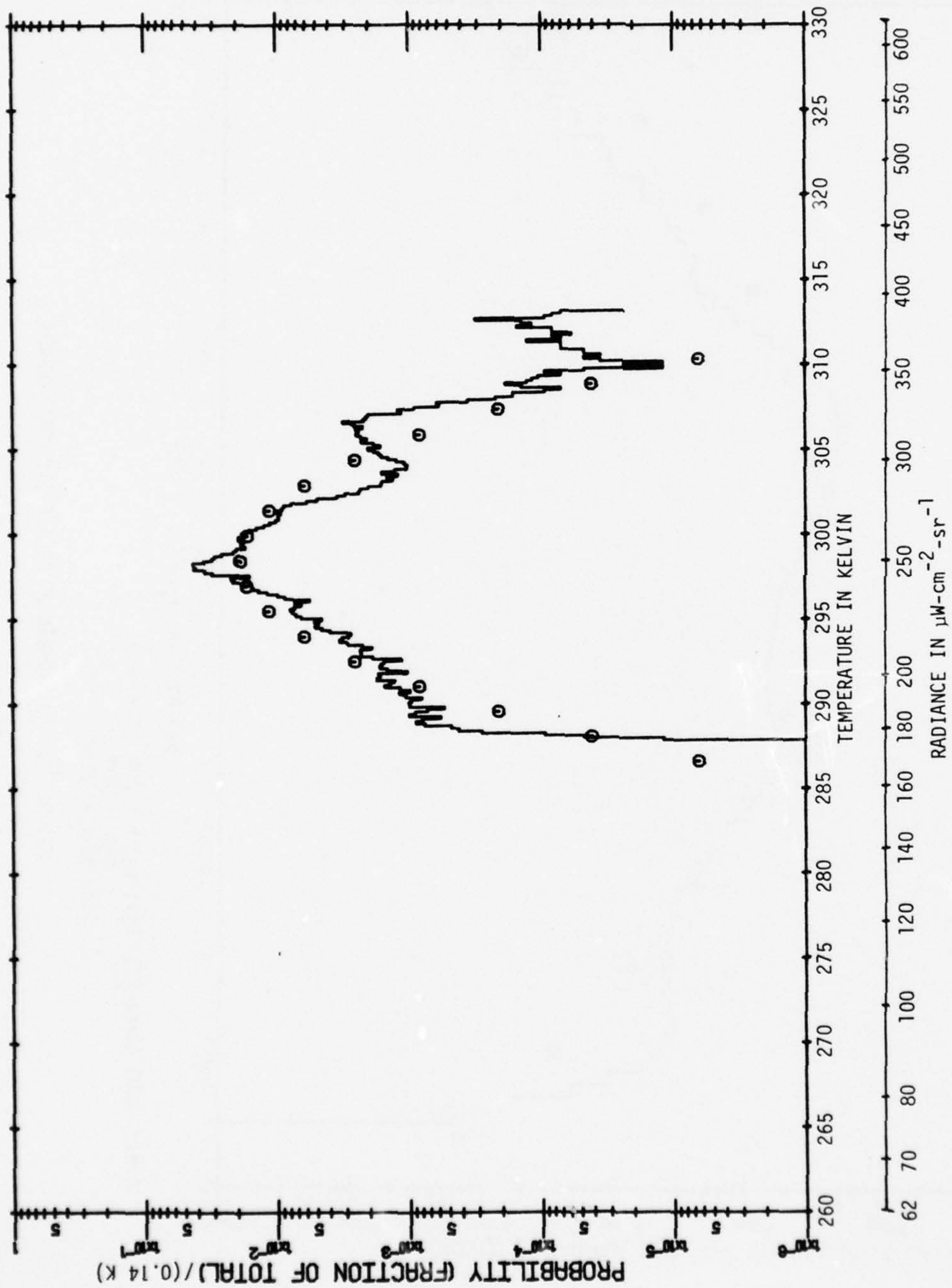
Area: HUM1 (Area #1) Wavelength = 9.0 - 11.4 μm
Mean = 297.31
Std. Dev. = 8.23

FIGURE 6c. HISTOGRAM OF AREA #1 AT PORT HUENEME



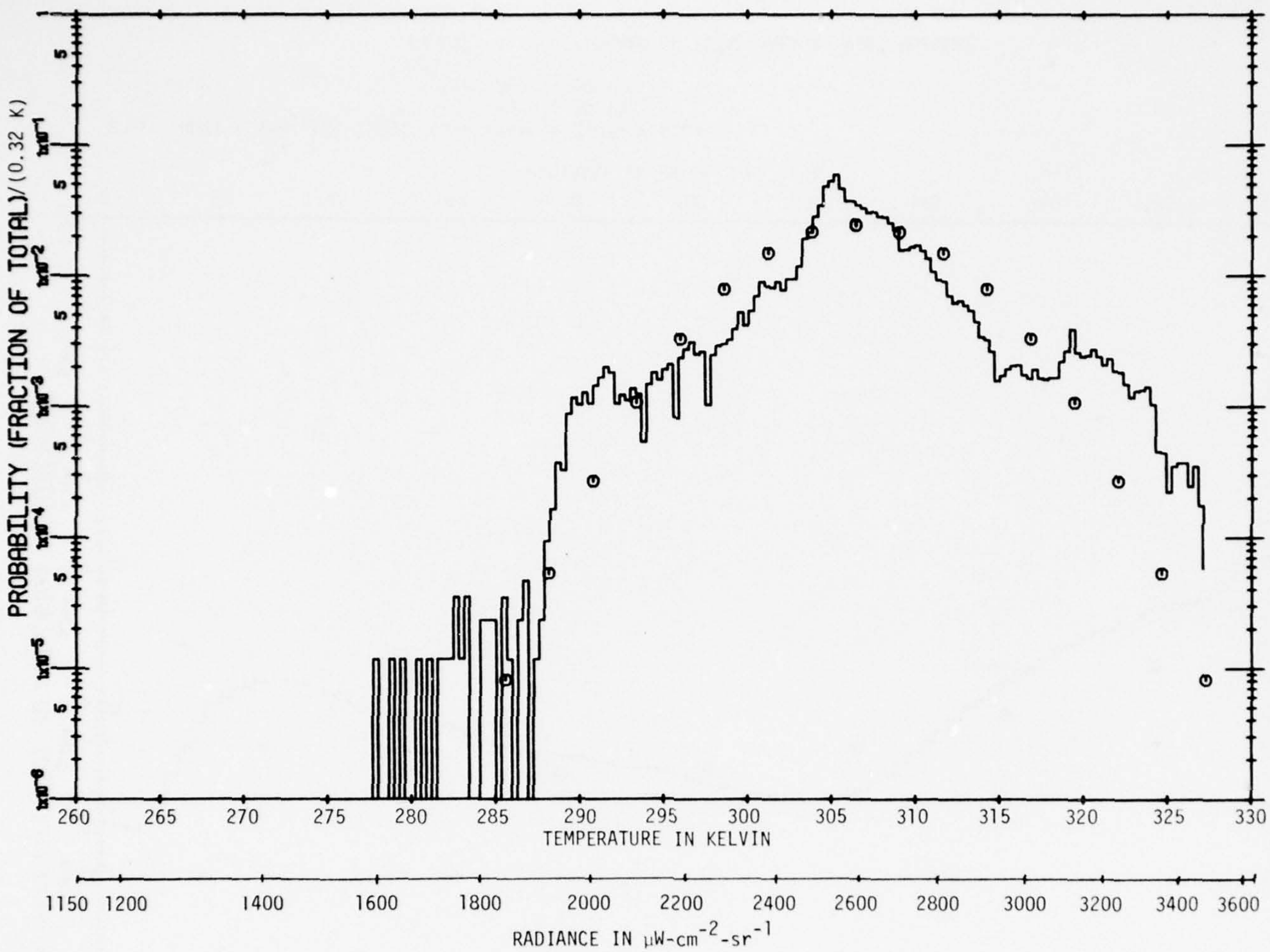
Area: HUM1 (Area #2) Wavelength = 2.0 - 2.6 μm
Mean = 108.93
Std. Dev. = 28.58

FIGURE 7a. HISTOGRAM OF AREA #2 AT PORT HUENEME



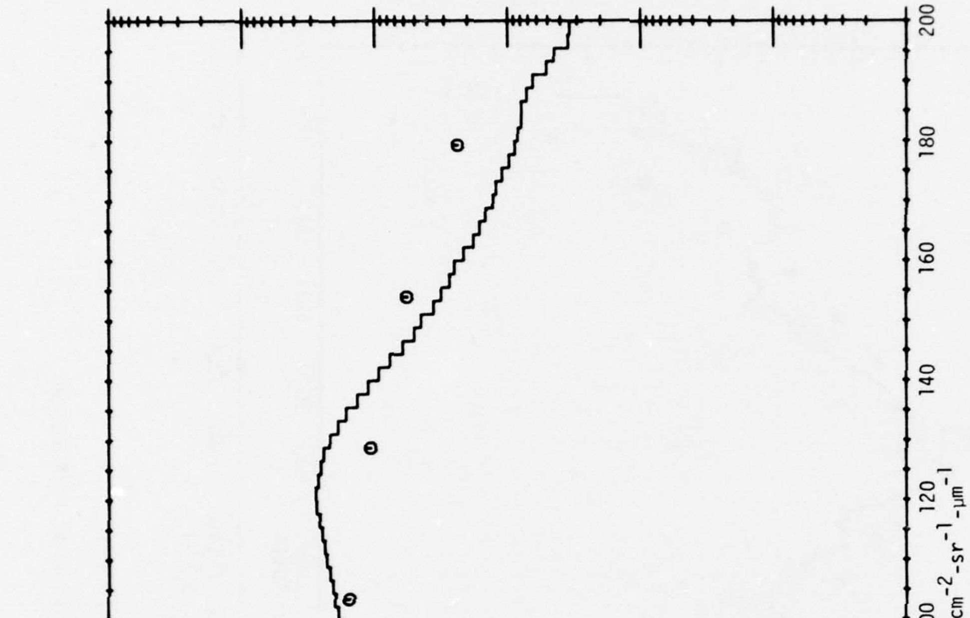
Area: HUM1 (Area #2) Wavelength = 4.5 - 5.5 μm
Mean = 298.47
Std. Dev. = 2.97

FIGURE 7b. HISTOGRAM OF AREA #2 AT PORT HUENEME



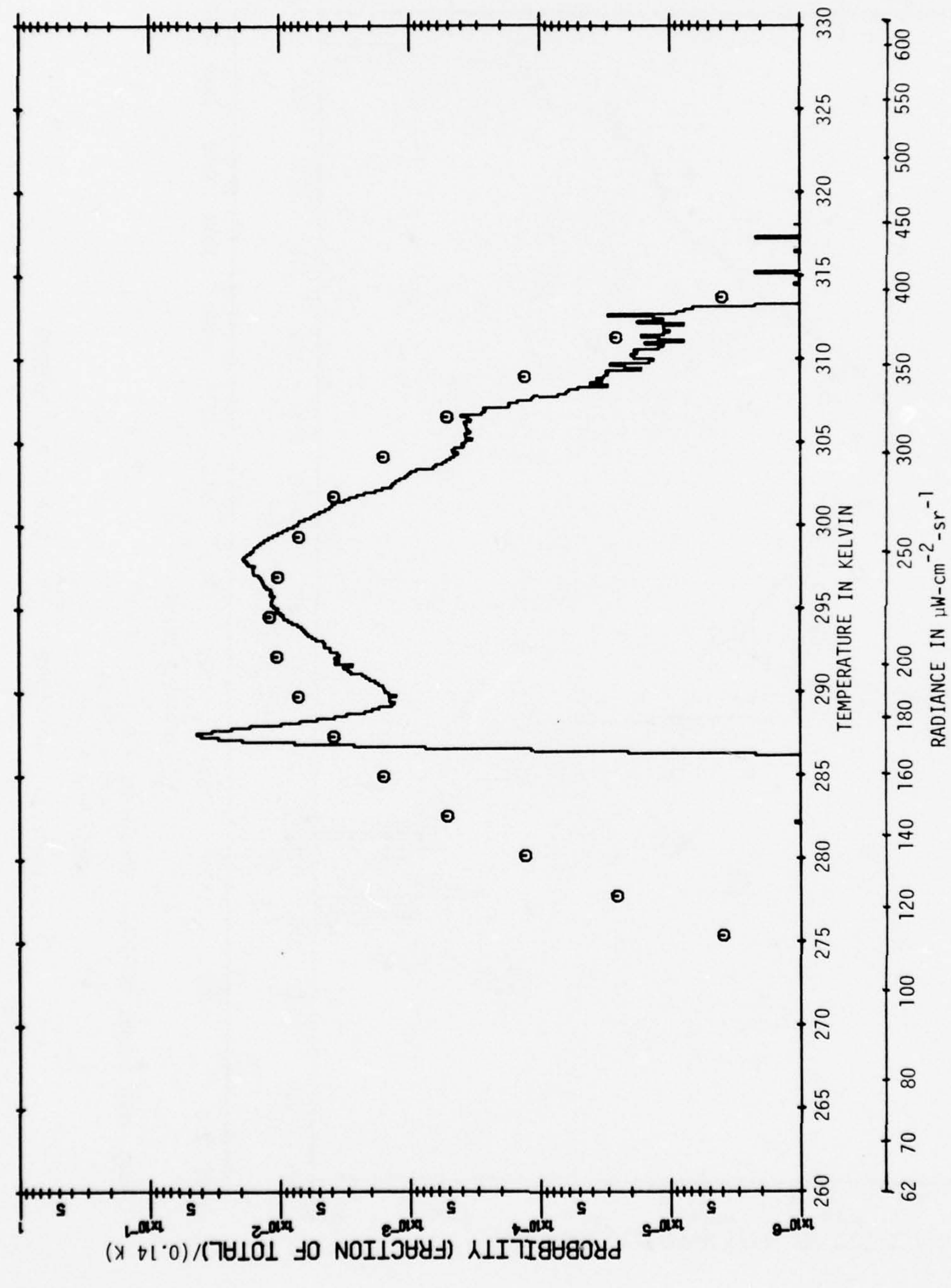
Area: HUM1 (Area #2) Wavelength = 9.0 - 11.4 μm
Mean = 306.40
Std. Dev. = 5.21

FIGURE 7c. HISTOGRAM OF AREA #2 AT PORT HUENEME



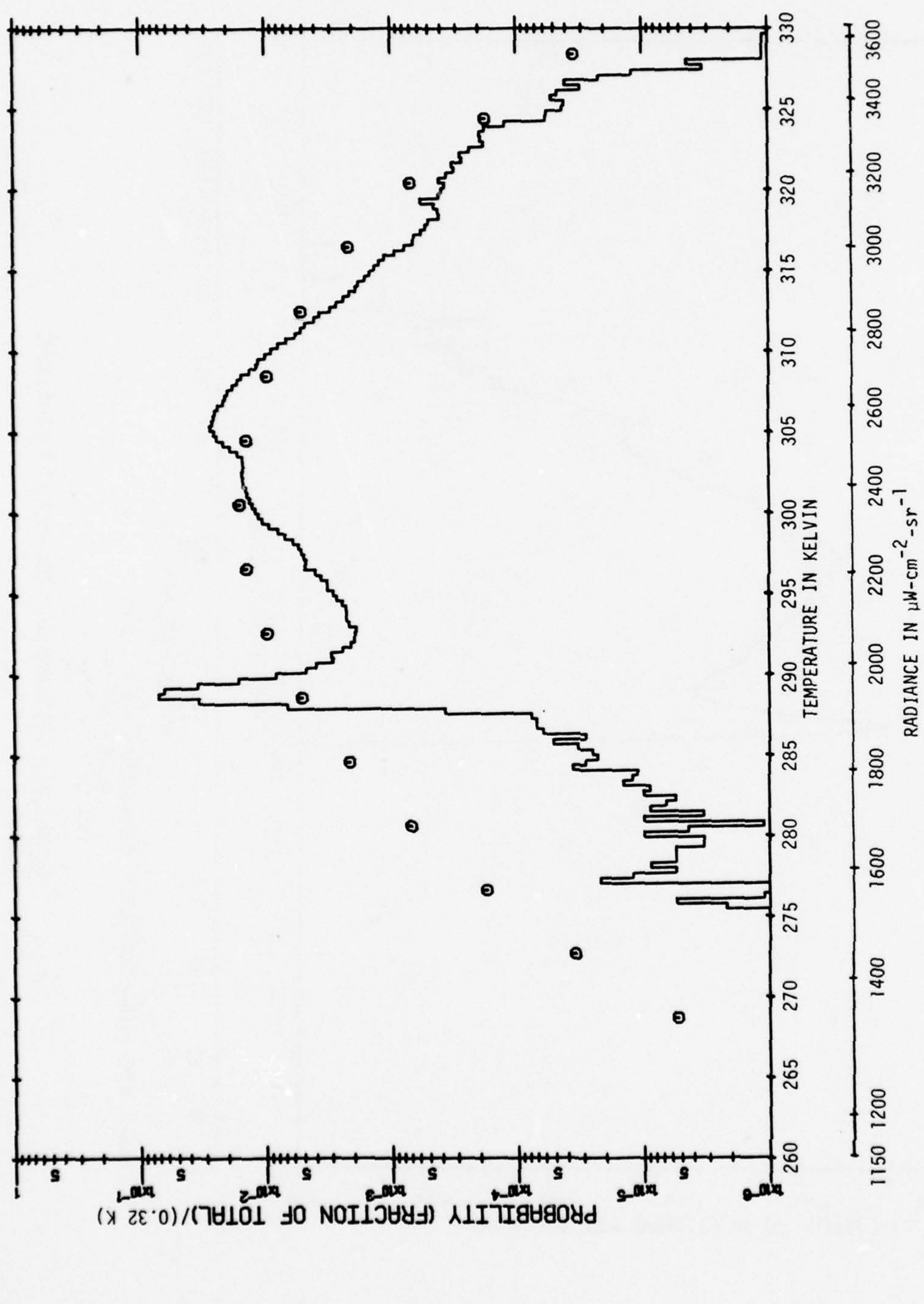
Area: HUM1 (Lines 101-1550) Wavelength = 2.0 - 2.6 µm
Mean = 78.13
Std. Dev. = 50.52

FIGURE 8a. HISTOGRAM OF TOTAL AREA AT PORT HUENEME



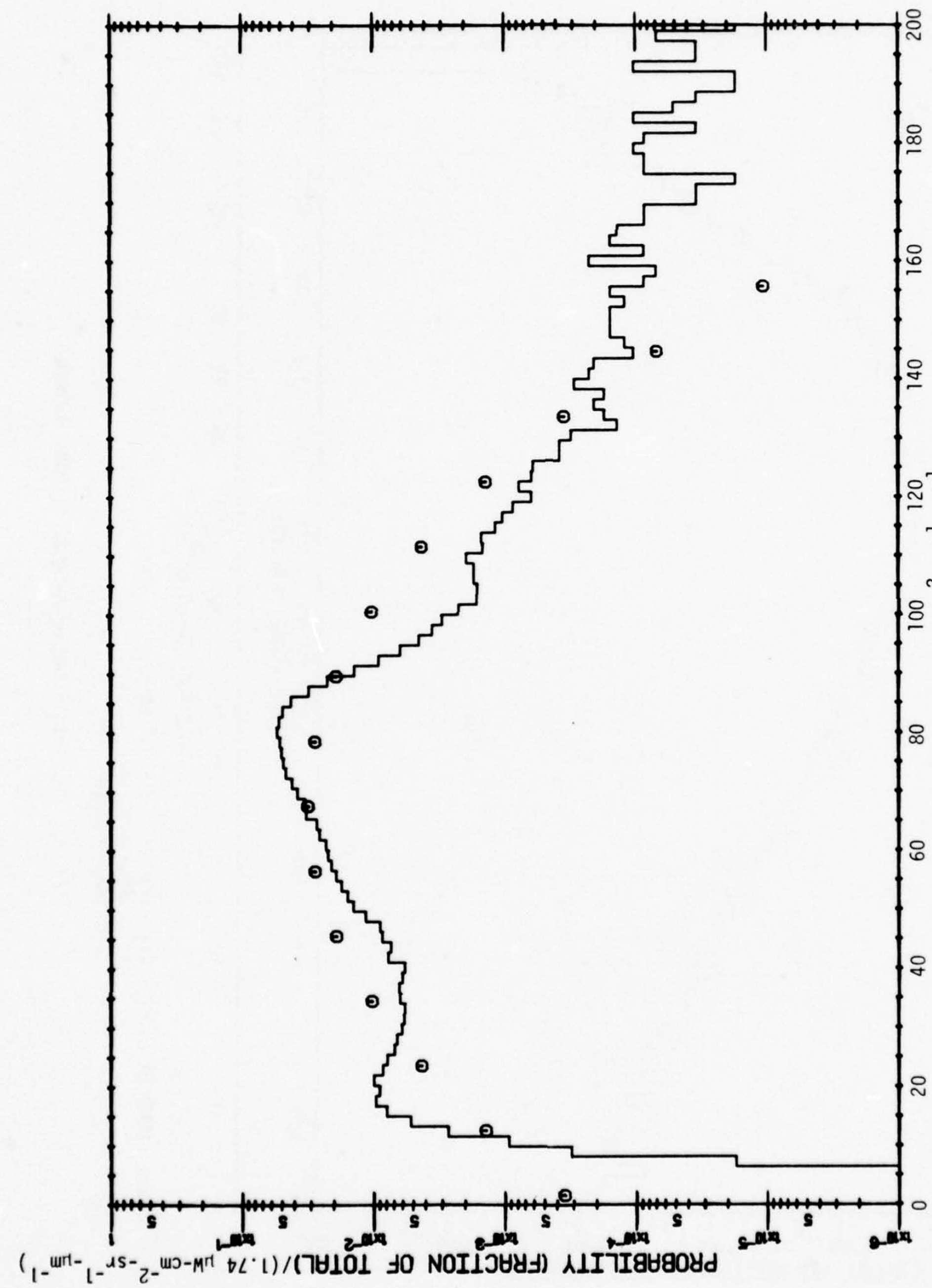
Area: HUM1 (Lines 101-1550) Wavelength = 4.5 - 5.5 μm
Mean = 294.54
Std. Dev. = 4.79

FIGURE 8b. HISTOGRAM OF TOTAL AREA AT PORT HUENEME



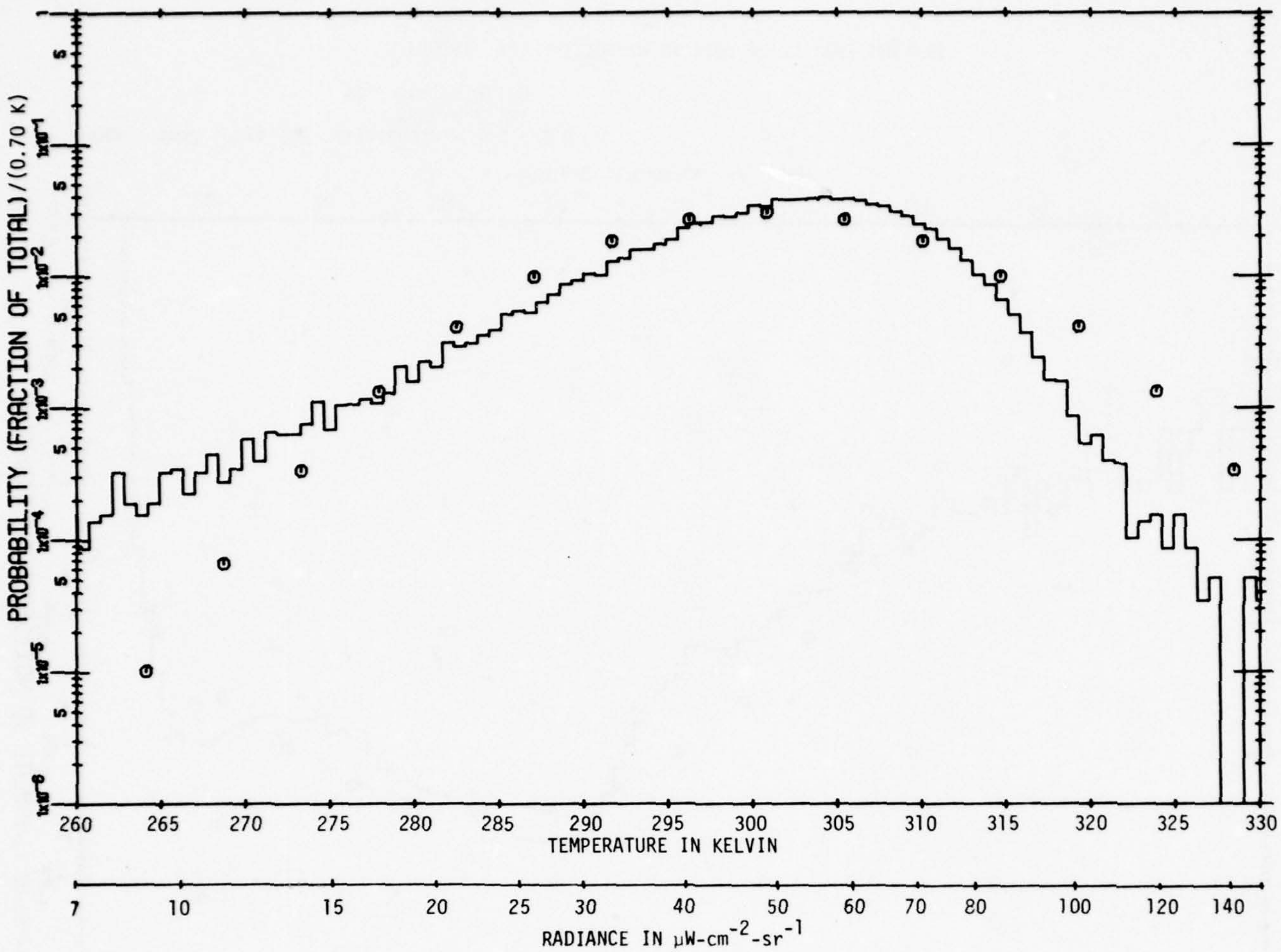
Area: HUM1 (Lines 101-1550) Wavelength = 9.0 - 11.4 μm
Mean = 300.54
Std. Dev. = 7.96

FIGURE 8c. HISTOGRAM OF TOTAL AREA AT PORT HUENEME



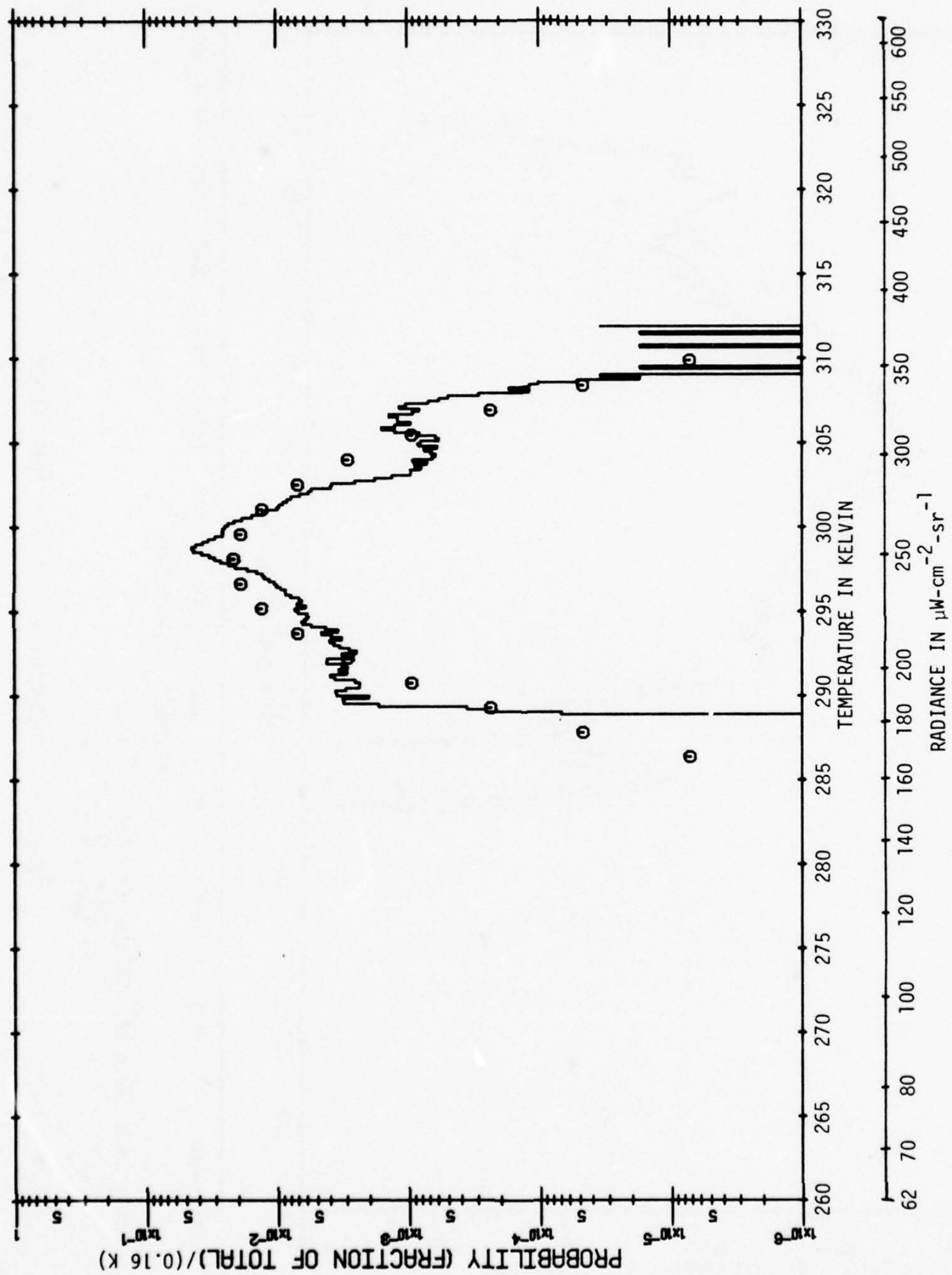
Area: HUM2 (Area #2) Wavelength = 2.0 - 2.6 μm
Mean = 67.81
Std. Dev. = 22.00

FIGURE 9a. HISTOGRAM OF AREA #2 AT PORT HUENEME



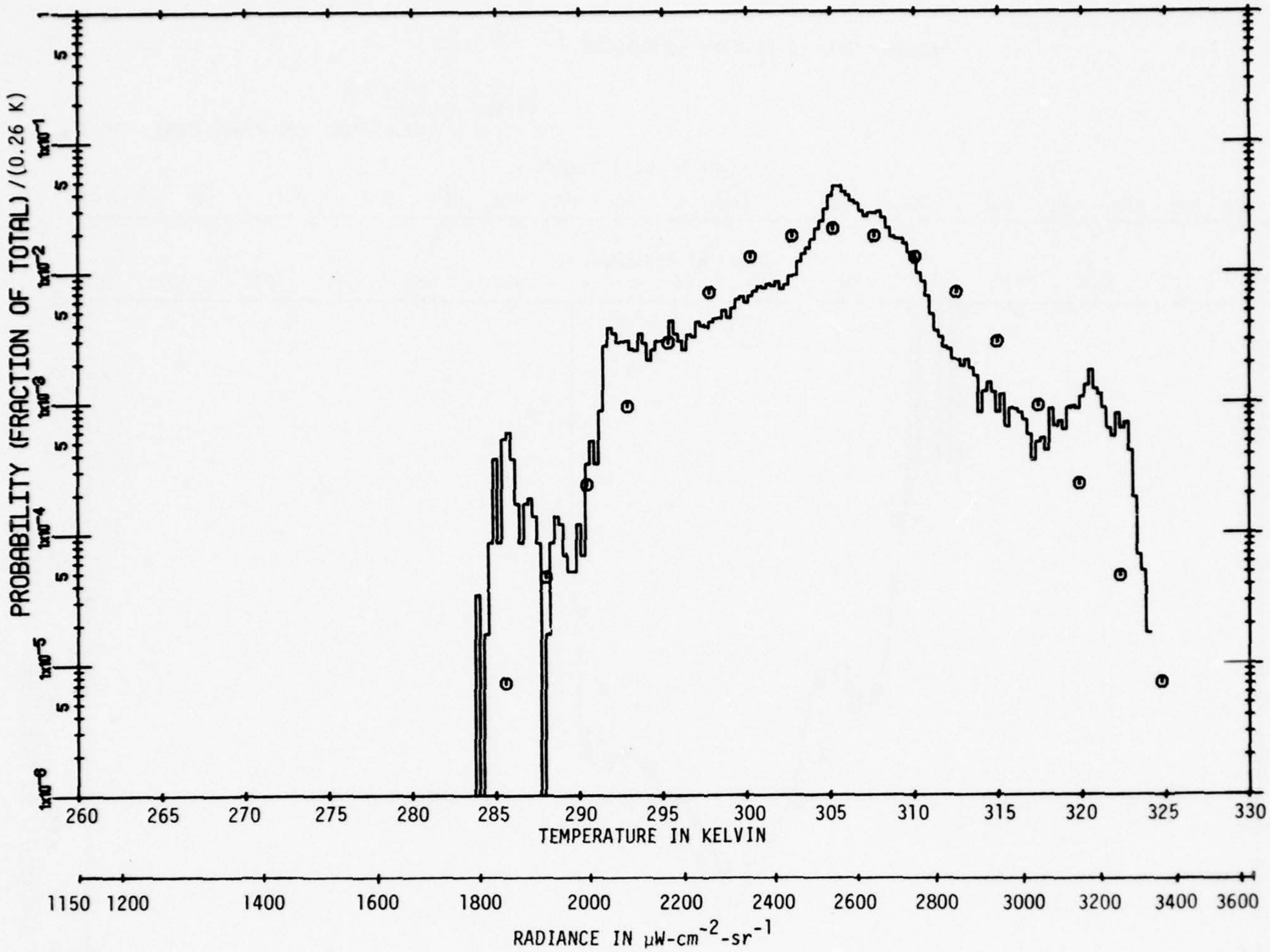
Area: HUM2 (Area #2) Wavelength = 3.0 - 4.2 μm
Mean = 300.87
Std. Dev. = 9.19

FIGURE 9b. HISTOGRAM OF AREA #2 AT PORT HUENEME



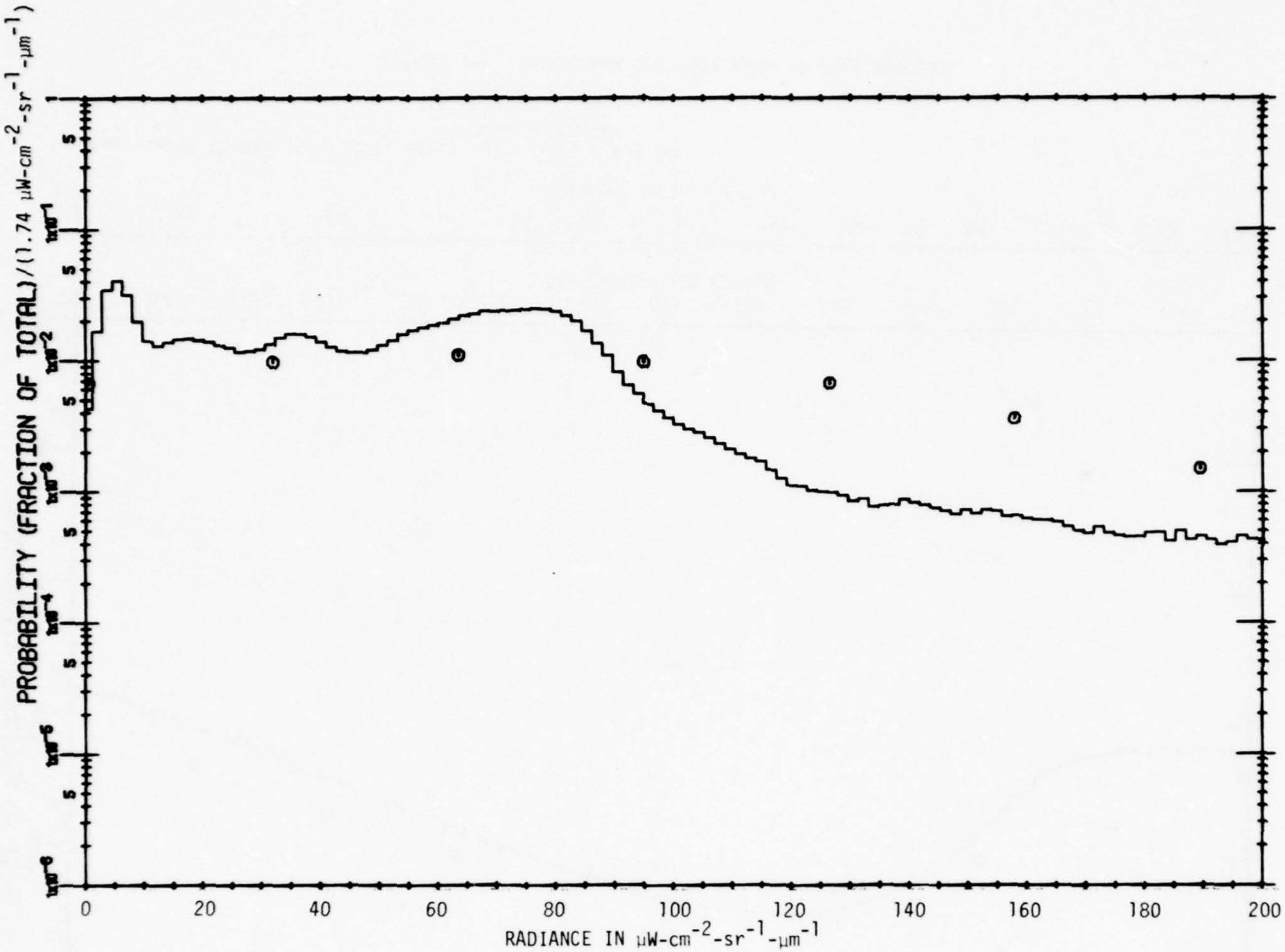
Area: HUM2 (Area #2) Wavelength = 4.5 - 5.5 μm
Mean = 298.13
Std. Dev. = 2.94

FIGURE 9c. HISTOGRAM OF AREA #2 AT PORT HUENEME



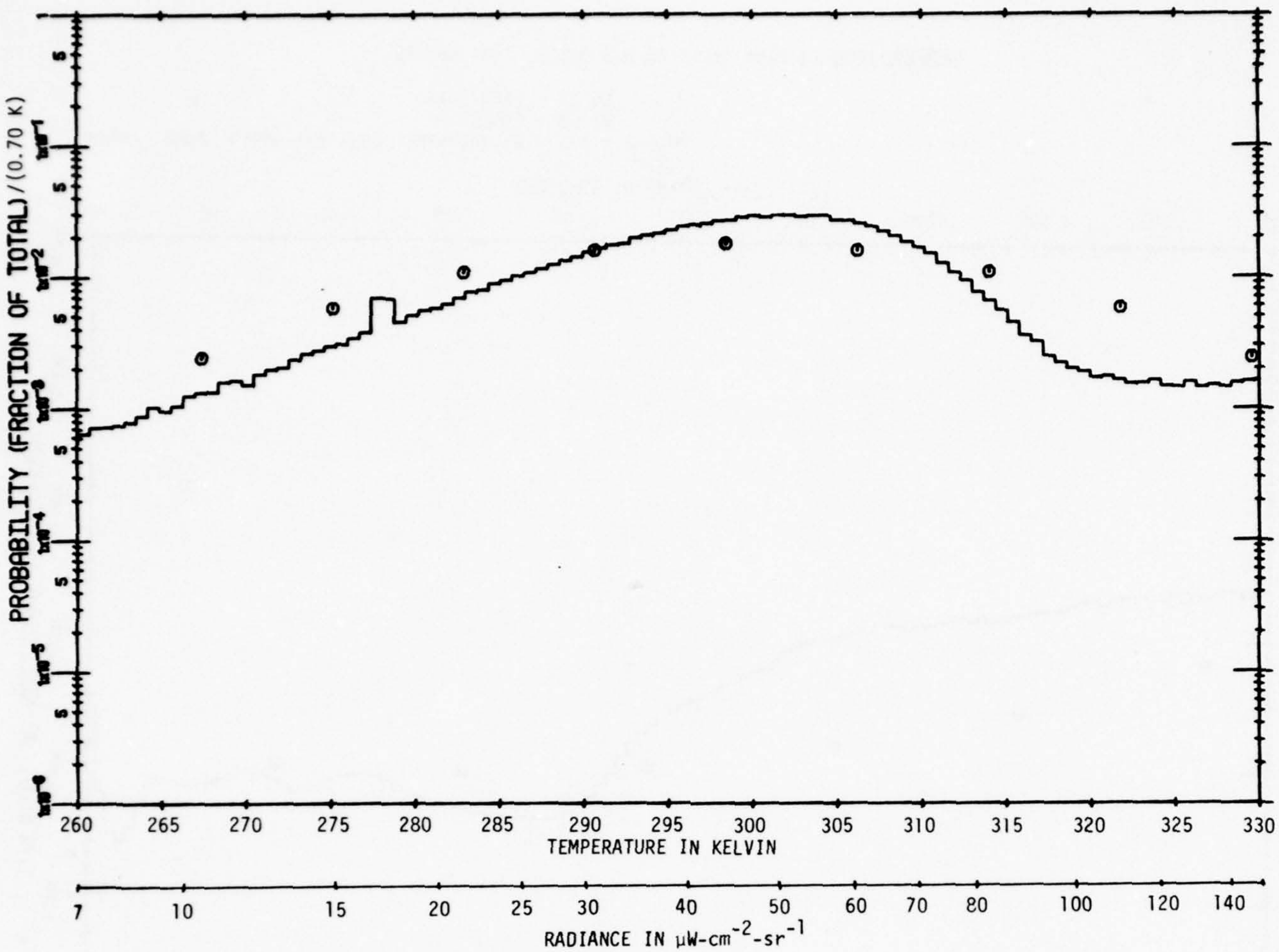
Area: HUM2 (Area #2) Wavelength = 9.0 - 11.4 μm
Mean = 305.14
Std. Dev. = 4.90

FIGURE 9d. HISTOGRAM OF AREA #2 AT PORT HUENEME



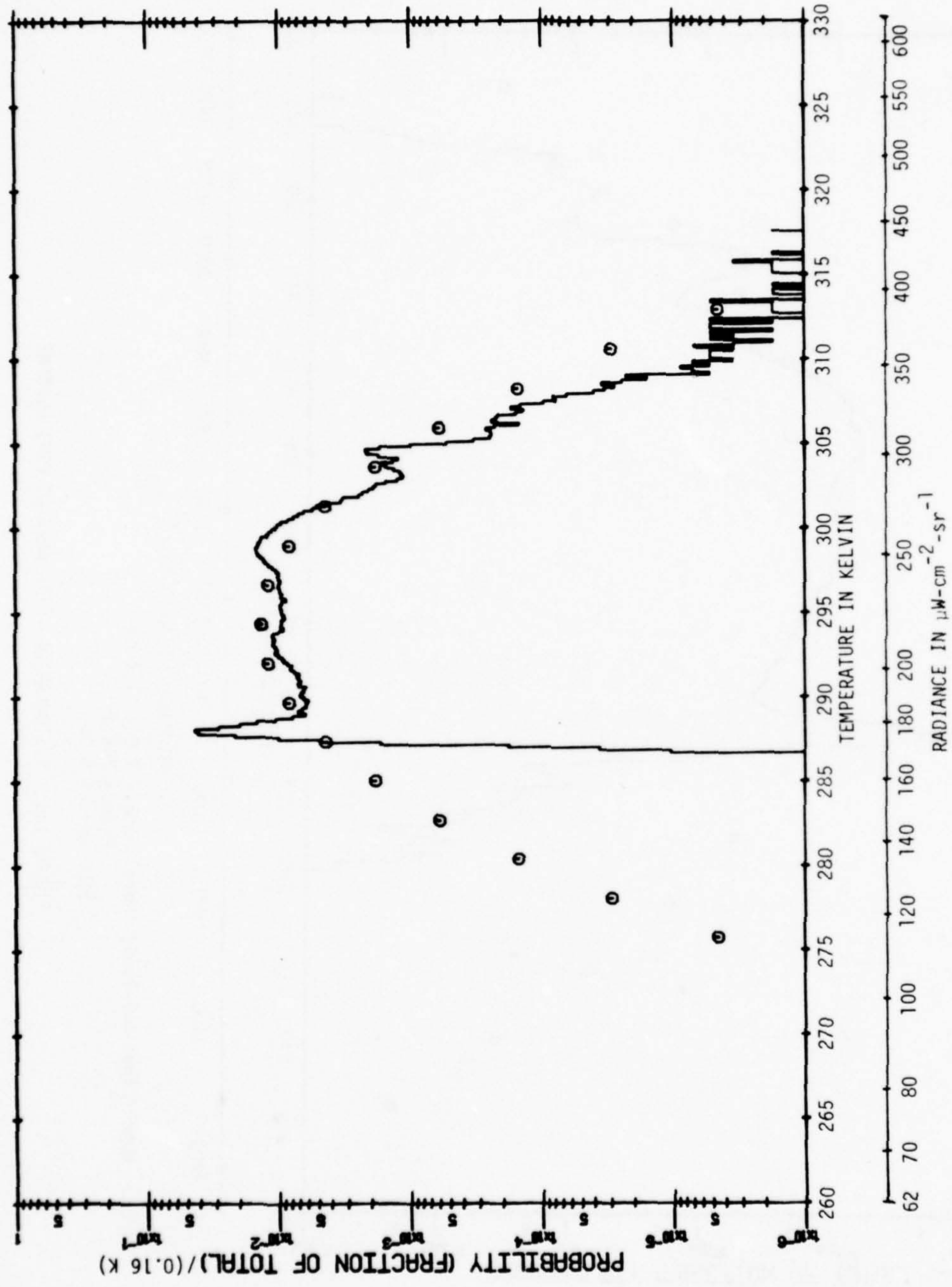
Area: HUM2 (Lines 101-1550) Wavelength = 2.0 - 2.6 μm
Mean = 63.48
Std. Dev. = 62.95

FIGURE 10a. HISTOGRAM OF TOTAL AREA AT PORT HUENEME



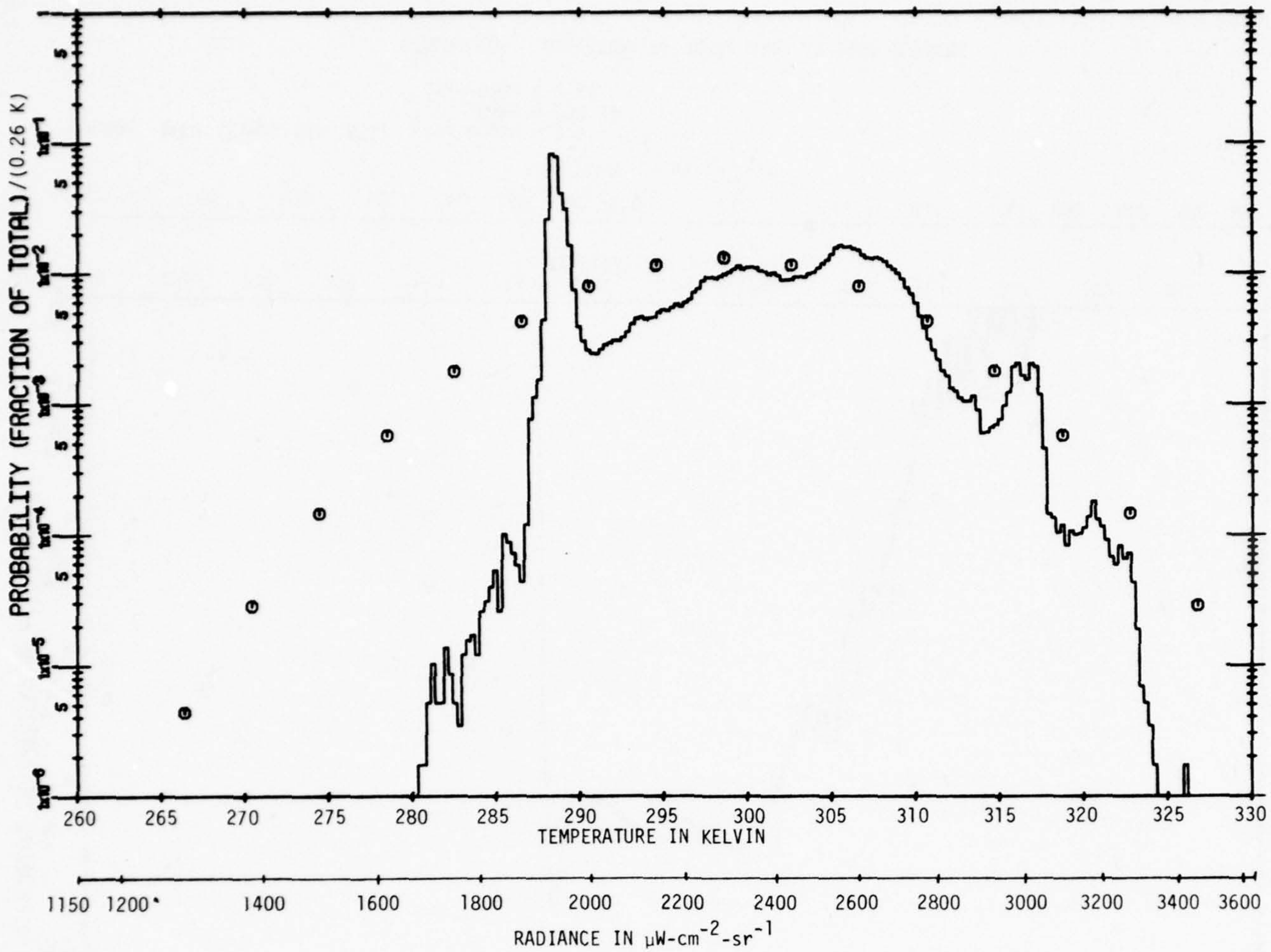
Area: HUM2 (Lines 101-1550) Wavelength = 3.0 - 4.2 μm
Mean = 298.48
Std. Dev. = 15.53

FIGURE 10b. HISTOGRAM OF TOTAL AREA AT PORT HUENEME



Area: HUM2 (Lines 101-1550) Wavelength = 4.5 - 5.5 μm
Mean = 294.33
Std. Dev. = 4.64

FIGURE 10c. HISTOGRAM OF TOTAL AREA AT PORT HUENEME



Area: HUM2 (Lines 101-1550) Wavelength = 9.0 - 11.4 μm
Mean = 298.58
Std. Dev. = 8.05

FIGURE 10d. HISTOGRAM OF TOTAL AREA AT PORT HUENEME

The latter tends to be the more important in causing deviations between the two thermal spectral regions. We find that in the 9.0-11.4 μm band, the atmosphere is virtually non-attenuating for the approximately 2000-foot distance in each case between radiator and receiver. However, depending on humidity, the 4.5-5.5 μm band can be severely affected by H_2O vapor absorption. In fact, if one assumes (1) a transmittance of approximately 50 percent in this region (not at all unreasonable for moderate H_2O concentrations), causing a loss of 50 percent of the relatively high temperature radiation from the land surfaces, and (2) that the path between radiator and receiver re-radiates with 50 percent emissivity at approximately the water temperature of about 288K, then the difference in the temperature for the two spectral regions is about what we find from the mean temperatures given on the figures.

Furthermore, we should note that the peaks of the distributions, representing the water temperature with very little spread, are a nearly the same temperature for both bands, with the value for 4.5-5.5 μm falling slightly below that for 9.0-11.4 μm, as expected.

The above events are a good argument for representing the distributions in terms of temperature. Normalization of the Planck curve makes it easier to observe differences in the behavior of different thermal regions whether imaginary or real.

3
SPECTRAL CORRELATIONS

The overall statistics of the various regions are given in Tables 2 through 6 where the means and standard deviations are recorded, as well as the correlations between the different spectral bands. Table 2, for example, shows the values for Area #1, which was subdivided into four smaller, equal areas, designated by the numbers 1, 2, 3, and 4 on the greymap of Figure 4. Only Area #1 was subdivided. The spectral bands in this and the other tables are designated by channel number with the following correspondence:

TABLE 2

Area #1 - HUME1

Number of Subregions = 4

Pixel Subarea Divisions at: 1 138 276

Line Subarea Divisions at: 976 1126 1276

Line Increment Used = 1

Pixel Increment Used = 1

Correlation Channels: 6 (2.0 - 2.6 μm)
11 (4.5 - 5.5 μm)
12 (9.0 - 11.4 μm)

Subarea 1

Correlation	6	11	12
6	1.000		
11	0.847	1.000	
12	0.832	0.943	1.000

Channels	6	11	12
Mean	5.7475E+01	2.9328E+02	2.9941E+02
St. Dev.	4.4586E+01	4.8267E+00	8.6960E+00
Total Pts.	20687.	20687.	20687.

Subarea 2

Correlation	6	11	12
6	1.000		
11	0.904	1.000	
12	0.903	0.959	1.000

Channels	6	11	12
Mean	1.1728E+01	2.8821E+02	2.9007E+02
St. Dev.	2.3041E+01	2.8879E+00	4.9011E+00
Total Pts.	20838.	20838.	20838.

TABLE 2 (Cont'd)

Area #1 - HUME1

Subarea 3

Correlation	6	11	12
6	1.000		
11	0.416	1.000	
12	0.178	0.723	1.000

Channels	6	11	12
Mean	9.2962E+01	2.9515E+02	3.0190E+02
St. Dev.	4.6965E+01	3.2393E+00	5.7173E+00
Total Pts.	20550.	20550.	20550.

Subarea 4

Correlation	6	11	12
6	1.000		
11	0.798	1.000	
12	0.801	0.882	1.000

Channels	6	11	12
Mean	6.1556E+01	2.9299E+02	2.9793E+02
St. Dev.	4.8579E+01	4.5205E+00	7.7607E+00
Total Pts.	20700.	20770.	20770.

Total Area (Sum of Subareas)

Correlation	6	11	12
6	1.000		
11	0.803	1.000	
12	0.757	0.920	1.000

Channels	6	11	12
Mean	5.5789E+01	2.9240E+02	2.9731E+02
St. Dev.	5.1078E+01	4.7136E+00	8.2304E+00
Total Pts.	82775.	82775.	82775.

TABLE 3

Area #2 - HUME1

Number of Subregions = 1

Pixel Subarea Divisions at: 126 551

Line Subarea Divisions at: 416 616

Line Increment Used = 1

Pixel Increment Used = 1

Correlation Channels: 6 (2.0 - 2.6 μm)
11 (4.5 - 5.5 μm)
12 (9.0 - 11.4 μm)

Correlation	6	11	12
6	1.000		
11	-0.004	1.000	
12	-0.068	0.828	1.000

Channels	6	11	12
Mean	1.0893E+02	2.9847E+02	3.0640E+02
St. Dev.	2.8583E+01	2.9659E+00	5.2093E+00
Total Pts.	85425.	85425.	85425.

TABLE 4

Total Scene - HUME1

(Lines 101-1550)

Number of Subregions = 1

Pixel Subarea Divisions at: 10 636

Line Subarea Divisions at: 101 1550

Line Increment Used = 1

Pixel Increment Used = 1

Correlation Channels: 6 (2.0 - 2.6 μm)
11 (4.5 - 5.5 μm)
12 (9.0 - 11.4 μm)

Correlation	6	11	12
6	1.000		
11	0.791	1.000	
12	0.767	0.921	1.000

Channels	6	11	12
Mean	7.8128E+01	2.9454E+02	3.0054E+02
St. Dev.	5.0523E+01	4.7889E+00	7.9584E+00
Total Pts.	907700.	907700.	907700.

TABLE 5

Area #2 - HUME2

Number of Subregions = 1

Pixel Subarea Divisions at: 123 523

Line Subarea Divisions at: 681 826

Line Increment Used = 1

Pixel Increment Used = 1

Correlation Channels: 6 (2.0 - 2.6 μm)
10 (3.0 - 4.2 μm)
11 (4.5 - 5.5 μm)
12 (9.0 - 11.4 μm)

Correlation	6	10	11	12
6	1.000			
10	0.350	1.000		
11	0.460	0.327	1.000	
12	0.339	0.300	0.836	1.000

Channels	6	10	11	12
Mean	6.7610E+01	3.0087E+02	2.9813E+02	3.0514E+02
St. Dev.	2.2000E+01	9.1866E+00	2.9408E+00	4.8995E+00
Total Pts.	58400.	58400.	58400.	58400.

TABLE 6

Total Scene - HUME2

(Lines 101-1550)

Number of Subregions = 1

Pixel Subarea Divisions at: 123 523

Line Subarea Divisions at: 101 1550

Line Increment Used = 1

Pixel Increment Used = 1

Correlation Channels: 6 (2.0 - 2.6 μm)
10 (3.0 - 4.2 μm)
11 (4.5 - 5.5 μm)
12 (9.0 - 11.4 μm)

Correlation	6	10	11	12
6	1.000			
10	0.608	1.000		
11	0.356	0.329	1.000	
12	0.048	0.177	0.876	1.000

Channels	6	10	11	12
Mean	6.3483E+01	2.9848E+02	2.9433E+02	2.9858E+02
St. Dev.	6.2949E+01	1.5527E+01	4.6401E+00	8.0460E+00
Total Pts.	580000.	580000.	580000.	580000.

Channel 6: 2.0-2.6 μm ($\mu w\text{-}cm^{-2}\text{-}sr^{-1}\text{-}\mu m^{-1}$)

Channel 10: 3.0-4.2 μm (°K)

Channel 11: 4.5-5.5 μm (°K)

Channel 12: 9.0-11.4 μm (°K)

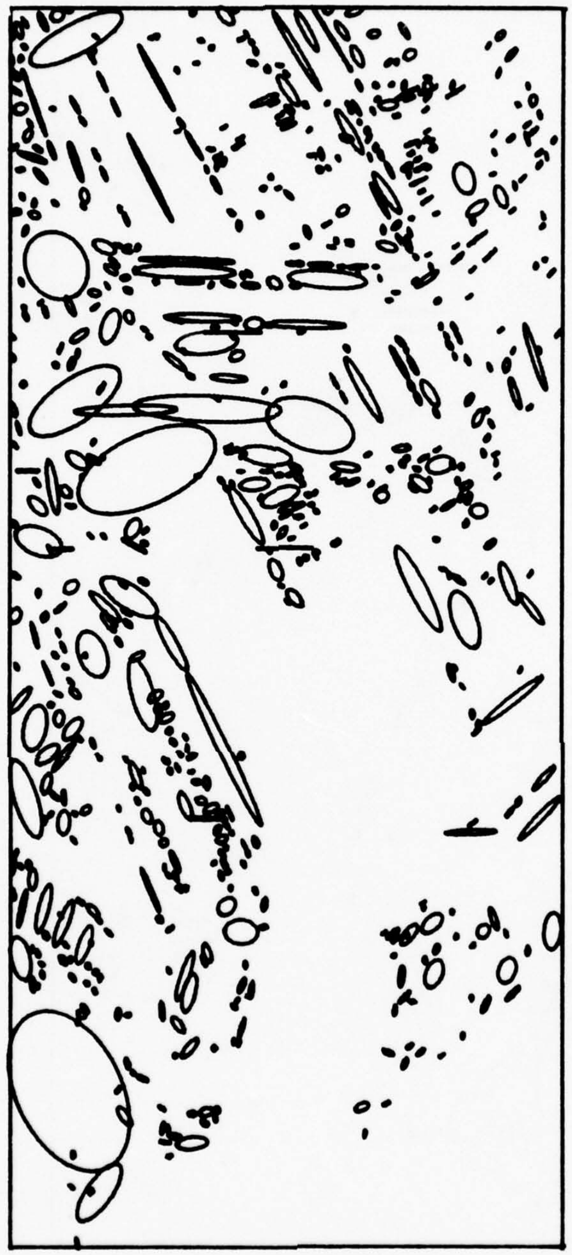
The units for the means and standard deviations in the different spectral bands are given in parentheses.

In light of the statement made earlier (in Section 2) about radiance and temperature statistics, we felt sufficiently confident to compare the results of the 2.0-2.6 μm band with those of the thermal region.

4
ELLIPSES

One of the statistics that is being gathered on various scenes as part of this backgrounds analysis program is "ellipse" statistics. These statistics are two-dimensional analogs of threshold crossing and pulse length statistics in one dimension. They are generated by identifying those contiguous areas in the image with data values that exceed some threshold value. The area corresponding to each cluster of contiguous pixels is then determined and tabulated. The centroid and first and second moments for each area are also determined to define an equivalent elliptical area, and tabulations are made of the distribution of contiguous areas in the image that exceed the threshold by area, perimeter, shape factor, or ratio of major-to-minor axis. These ellipse statistics are determined for each of several threshold settings. Single pixel and contiguous two-pixel exceedances are not included in the ellipse tabulations but the number of such exceedances are noted separately. The threshold levels are given in units of multiples (or fractions) of one standard deviation. Examples of ellipses for the various scenes are illustrated in Figures 11 and 12. Certain features in the ellipses are clearly associated with comparable details in the imagery shown in Figures 2 and 3.

Scanline #101



#1550

Area: HUM1

Radiance Threshold

= Ave. + 1.00 σ

Wavelength = 2.0 - 2.6 μm

FIGURE 11a. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101

#1550

Area: HUM1

Radiance Threshold

= Ave. + 1.50 σ

Wavelength = 2.0 - 2.6 μm

FIGURE 11b. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101

#1550

Area: HUM1

Radiance Threshold

= Ave. + 2.0 σ

Wavelength = 2.0 - 2.6 μm

FIGURE 11c. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101

#1550

Area: HUM1

Temperature Threshold

= Ave. + 2.00 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 11d. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101

#1550

Area: HUM1

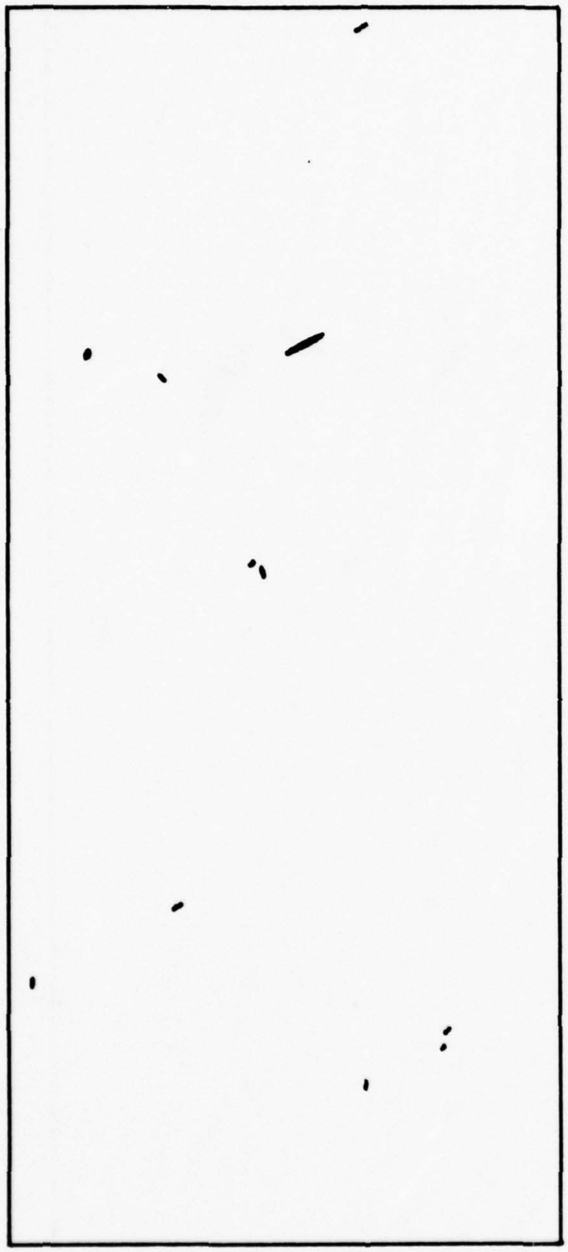
Temperature Threshold

= Ave. + 2.50 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 11e. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101



#1550

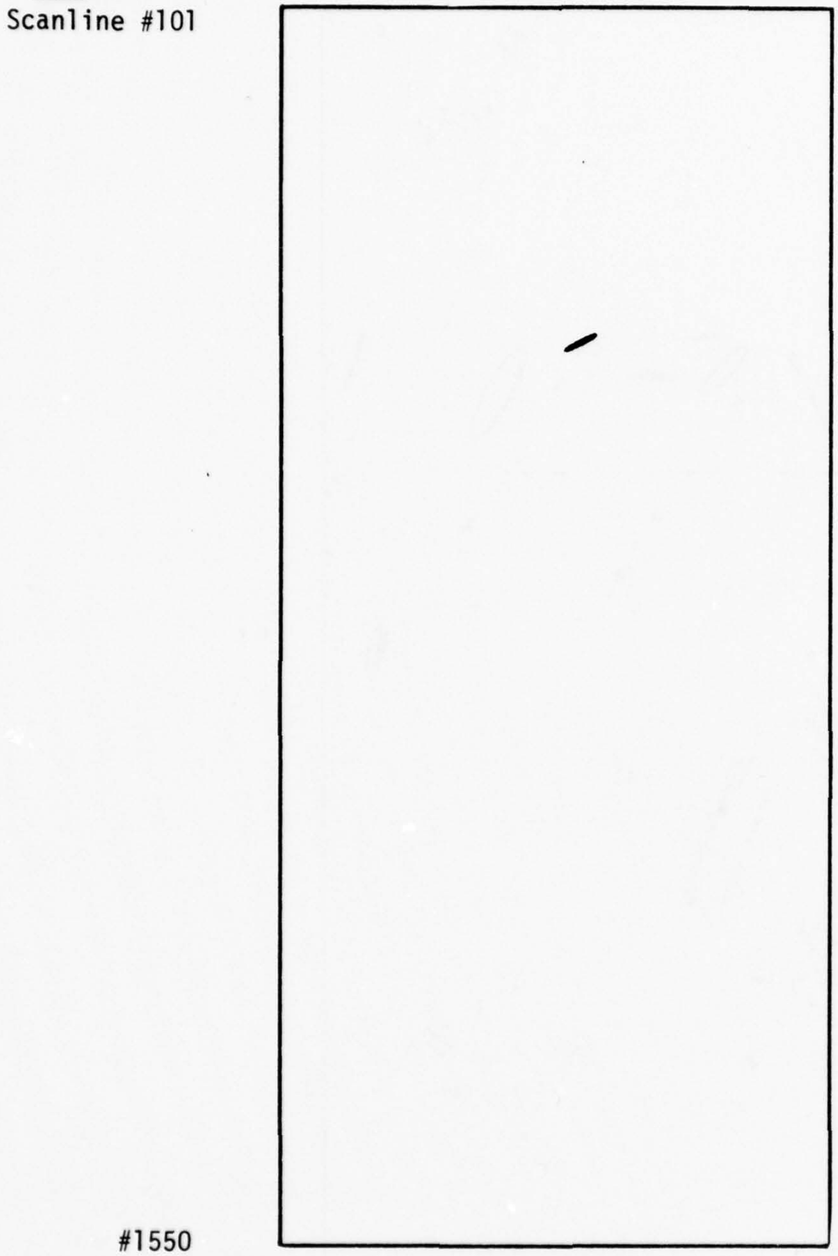
Area: HUM1

Temperature Threshold

= Ave. + 3.00 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 11f. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



Area: HUM1

Temperature Threshold

= Ave. + 3.50 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 11g. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101

#1550

Area: HUM1

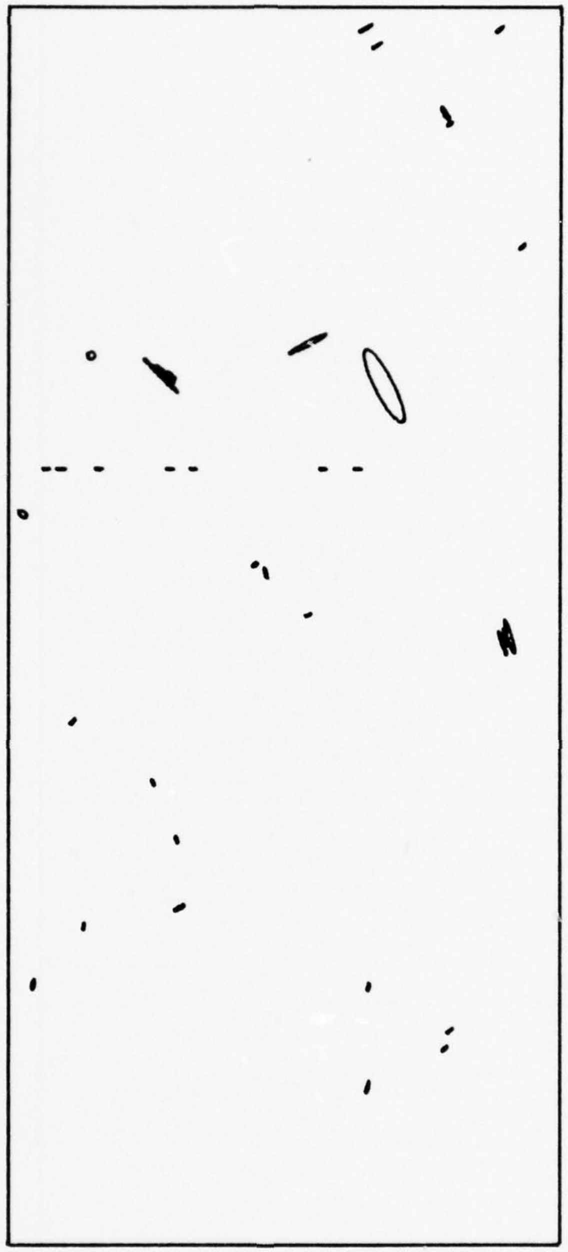
Temperature Threshold

= Ave. + 2.00 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 11h. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101



#1550

Area: HUM1

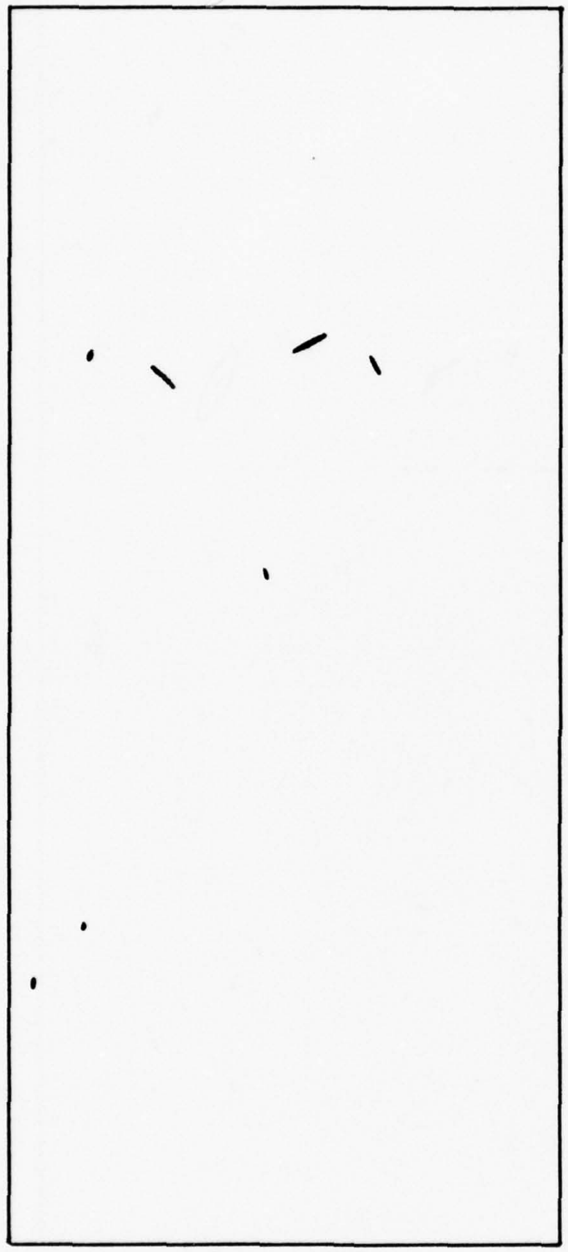
Temperature Threshold

= Ave. + 2.50 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 11i. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101



#1550

Area: HUM1

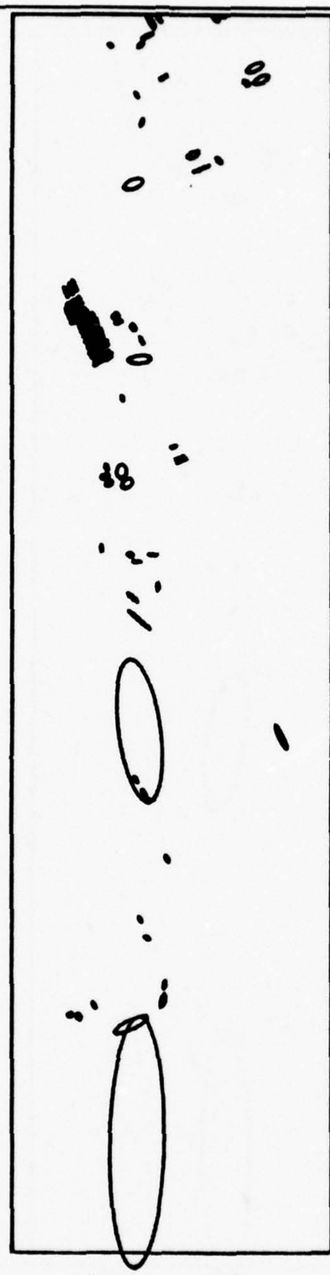
Temperature Threshold

= Ave. + 3.00 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 11j. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101



#1550

Area: HUM2

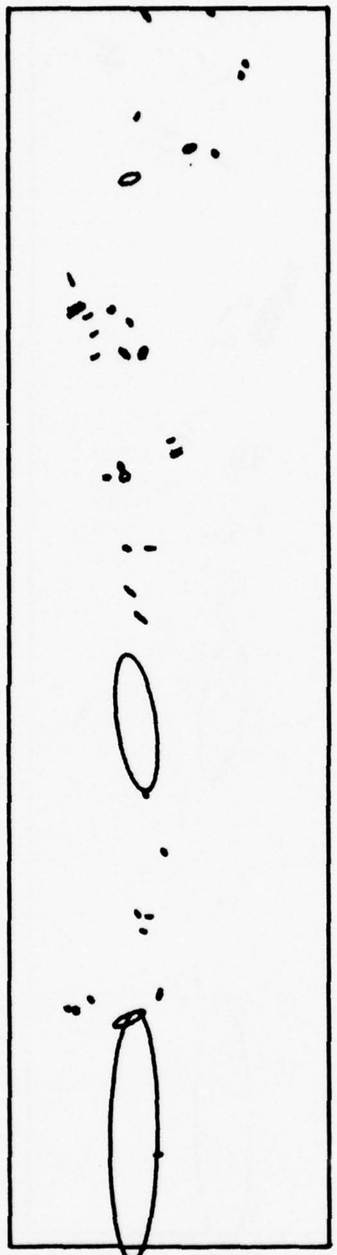
Radiance Threshold

= Ave. + 1.00 σ

Wavelength = 2.0 - 2.6 μm

FIGURE 12a. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101



#1550

Area: HUM2

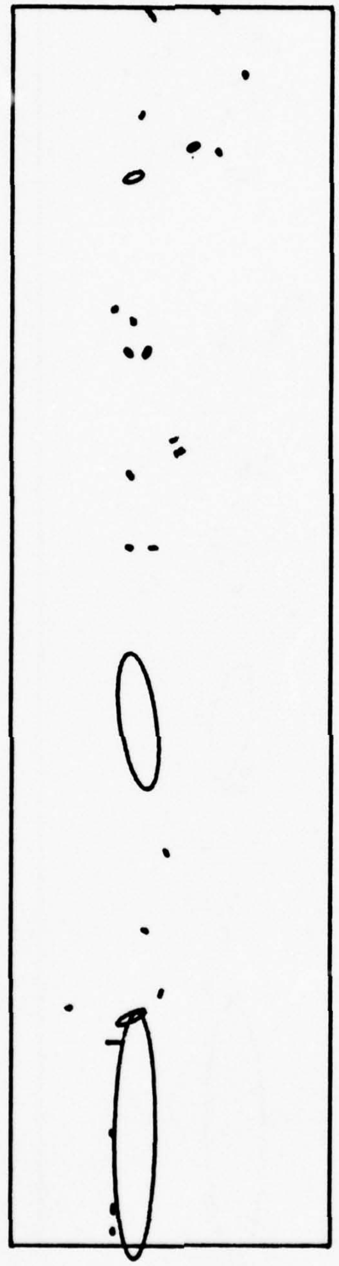
Radiance Threshold

= Ave. + 1.50 σ

Wavelength = 2.0 - 2.6 μm

FIGURE 12b. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101



#1550

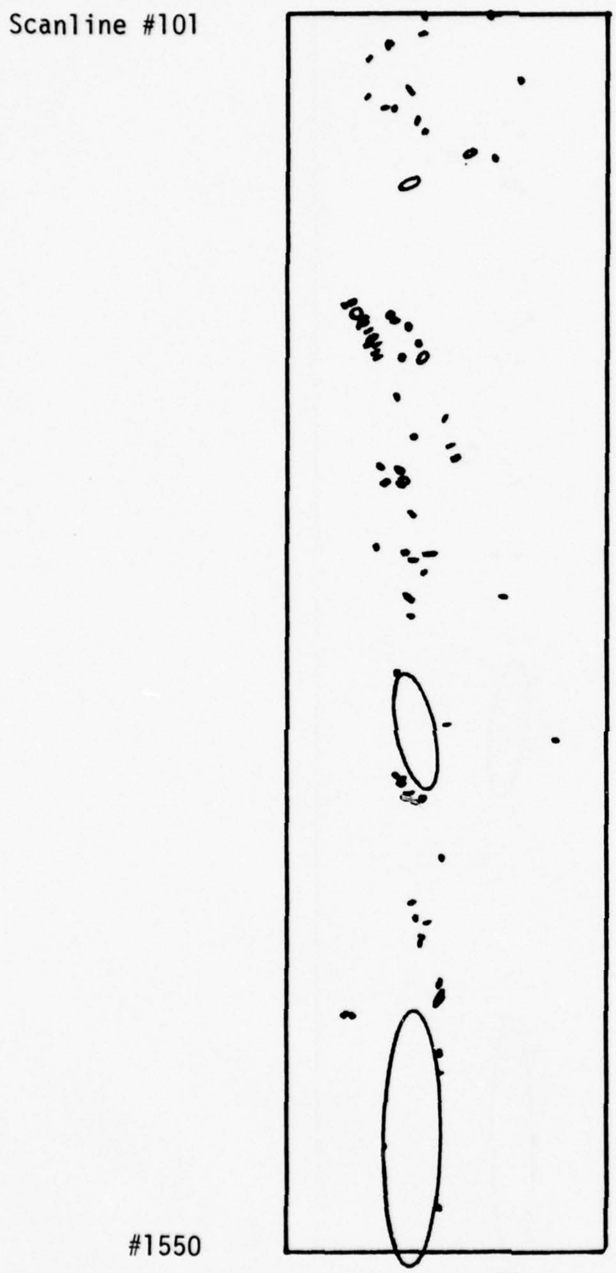
Area: HUM2

Radiance Threshold

= Ave. + 2.00 σ

Wavelength = 2.0 - 2.6 μm

FIGURE 12c. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



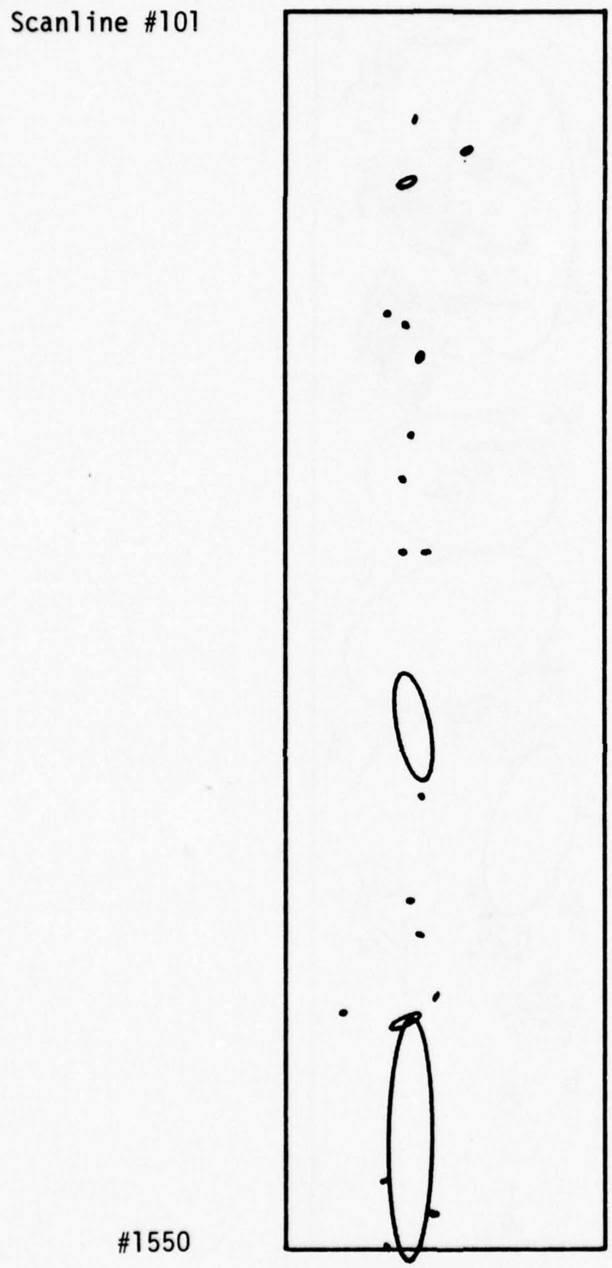
Area: HUM2

Temperature Threshold

= Ave. + 1.00 σ

Wavelength = 3.0 - 4.2 μm

FIGURE 12d. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



Area: HUM2

Temperature Threshold

= Ave. + 1.50 σ

Wavelength = 3.0 - 4.2 μm

FIGURE 12e. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101

#1550

Area: HUM2

Temperature Threshold

= Ave. + 0.50 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 12f. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101

#1550

Area: HUM2

Temperature Threshold

= Ave. + 1.00 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 12g. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101

#1550

Area: HUM2

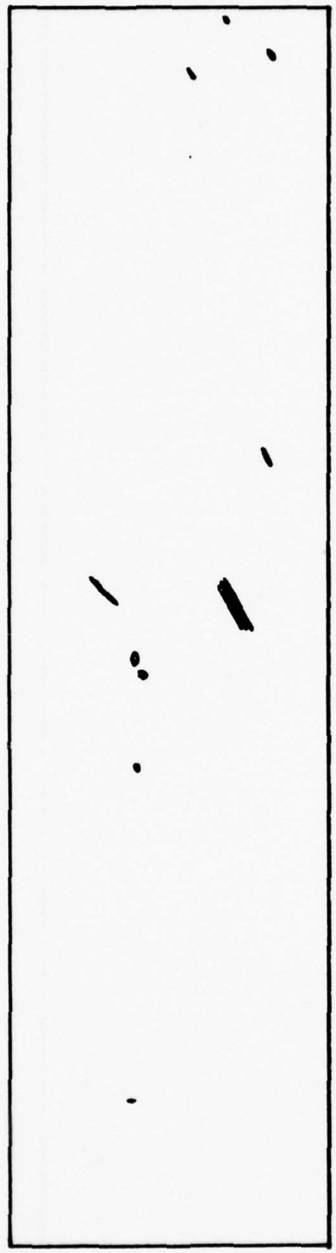
Temperature Threshold

= Ave. + 2.00 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 12h. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101



#1550

Area: HUM2

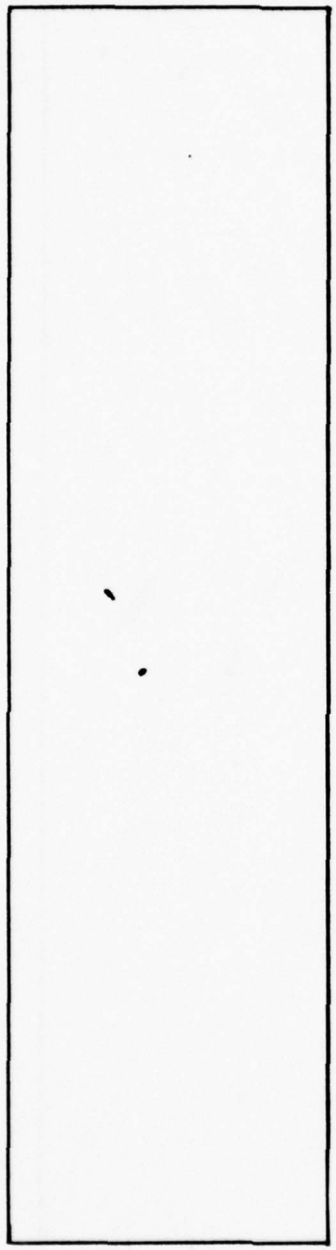
Temperature Threshold

= Ave. + 2.50 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 12i. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101



#1550

Area: HUM2

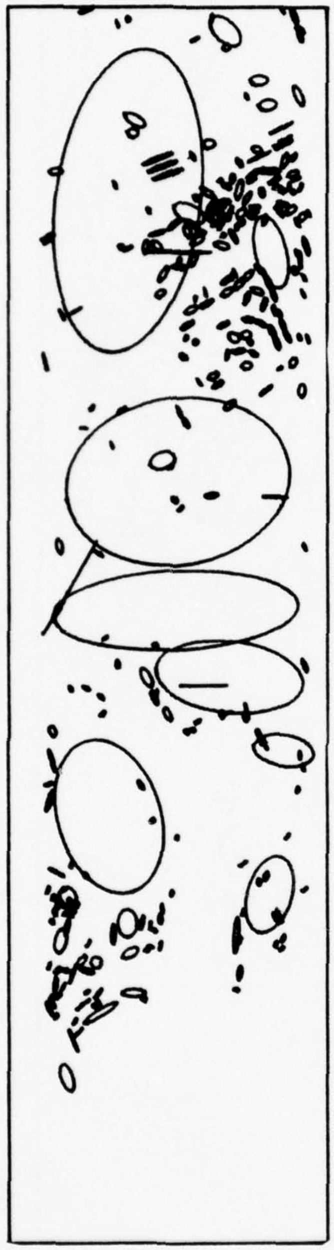
Temperature Threshold

= Ave. + 3.00 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 12j. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101



#1550

Area: HUM2

Temperature Threshold

= Ave. + 0.50 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 12k. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101

#1550

Area: HUM2

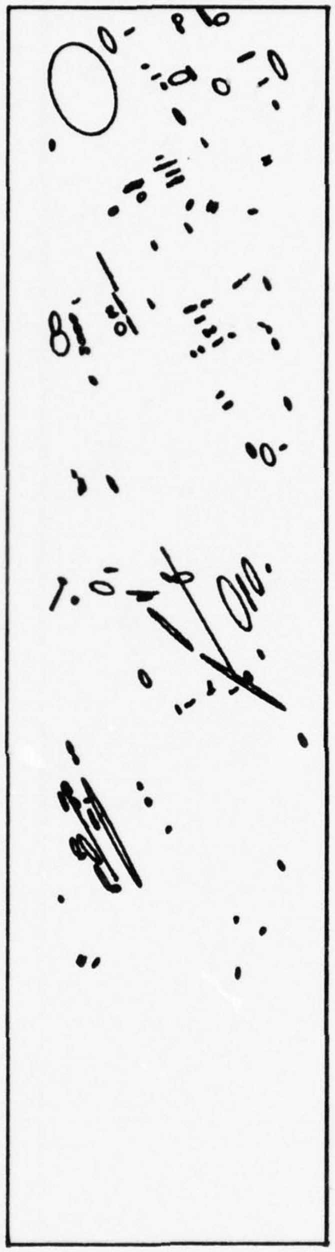
Temperature Threshold

= Ave. + 1.00 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 12ℓ. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101



#1550

Area: HUM2

Temperature Threshold

= Ave. + 1.50 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 12m. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101

#1550

Area: HUM2

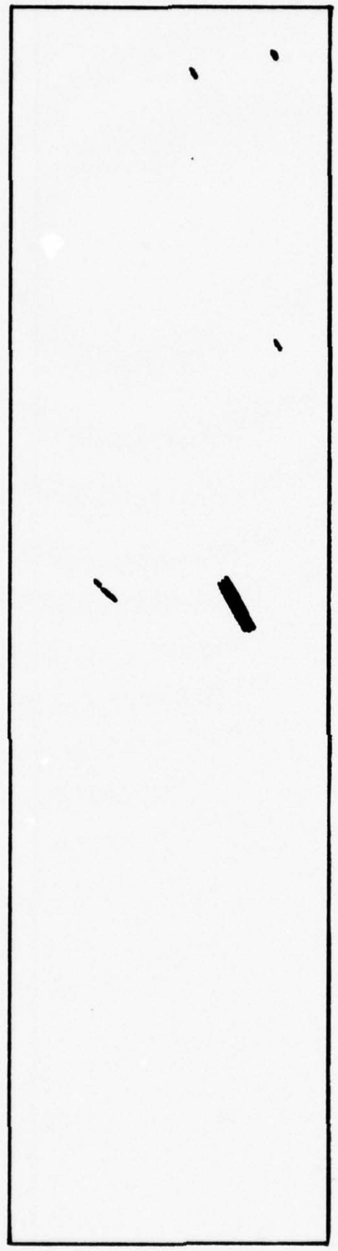
Temperature Threshold

= Ave. + 2.00 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 12n. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline #101



#1550

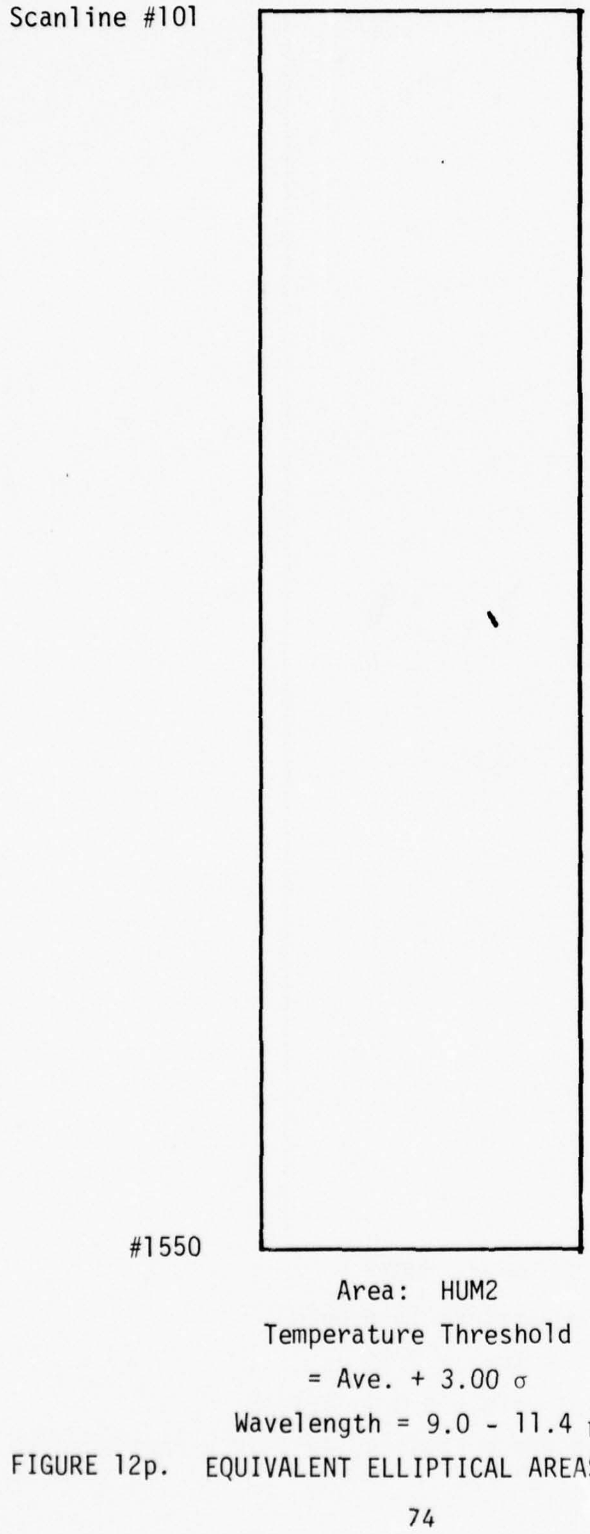
Area: HUM2

Temperature Threshold

= Ave. + 2.50 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 12o. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



Area: HUM2

Temperature Threshold

= Ave. + 3.00 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 12p. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Tables 7 and 8 show how the contiguous areas that exceed several thresholds are distributed by area (square meters), perimeter (meters), and shape factor. The shape factor (see Appendix A) is defined to be the ratio of the perimeter/2π and the square root of the area/π, i.e.,

$$\text{shape factor} = \frac{\text{perimeter}/2\pi}{(\text{area}/\pi)^{1/2}}$$

For a circular area, the shape factor would be unity.

Appendix A is included to show the sizes of the areas for which the ellipses were generated, and to give a little more insight into the ellipse representation of the scenery.

5
POWER SPECTRA

Included in the statistics of the areas analyzed are power spectra of the total area from each of the runs, HUME1 and HUME2. Considering the multimodal nature of the data, interpretation of the power spectra will be difficult. They are presented here for comparison of the different areas and spectral bands, and to show trends in the spatial quality of the data. The abscissa on these figures shows $(\text{amplitude})^2$ in order that we may put multiple curves on the same figure. However, for the 2.0-2.6 μm band, the amplitude is actually $\mu\text{w-cm}^{-2}\text{-sr}^{-1}\text{-}\mu\text{m}$, and for the other bands the amplitude is temperature in Kelvins. Figures 13 and 14 are one-dimensional power spectra identified as cross-track, and in-track, i.e., evaluated across and along the scan direction.

6
SUN GLINTS

A special area in the protected water region was analyzed from the HUME2 run to assess the effect of sun glint on the data. The histograms for these statistics are shown in Figures 15a-d, and the means, standard deviations and correlations are shown in Table 9. From the ellipse

TABLE 7

HUME1 - Total Scene
AREA DISTRIBUTIONS

(Threshold = Ave. + 1.0 σ
2.0 - 2.6 μm)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

SQUARE METERS		FREQUENCY
0.0 TO	5.0	0
5.0 TO	10.0	160
10.0 TO	15.0	237
15.0 TO	20.0	151
20.0 TO	25.0	91
25.0 TO	30.0	46
30.0 TO	35.0	56
35.0 TO	40.0	40
40.0 TO	45.0	27
45.0 TO	50.0	24
50.0 TO	75.0	90
75.0 TO	100.0	39
100.0 TO	150.0	48
150.0 TO	200.0	31
200.0 TO	250.0	16
250.0 TO	300.0	20
300.0 TO	400.0	15
400.0 TO	500.0	15
OVER	500.0	69

TOTAL NUMBER OF HOT SPOT = 1175

3300 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	31
14 TO 16	45 TO 52	0
16 TO 17	52 TO 55	97
17 TO 20	55 TO 65	118
20 TO 22	65 TO 72	92
22 TO 24	72 TO 78	0
24 TO 26	78 TO 85	89
26 TO 28	85 TO 91	63
28 TO 30	91 TO 98	43
30 TO 32	98 TO 104	0
32 TO 39	104 TO 127	140
39 TO 45	127 TO 147	61
45 TO 55	147 TO 180	80
55 TO 71	180 TO 232	71
71 TO 100	232 TO 328	74
OVER 100	OVER 328	216

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	7
1.2 TO 1.3	45
1.3 TO 1.4	59
1.4 TO 1.5	48
1.5 TO 1.6	106
1.6 TO 1.7	77
1.7 TO 1.8	112
1.8 TO 1.9	73
1.9 TO 2.0	58
2.0 TO 2.4	230
2.4 TO 2.6	66
2.6 TO 2.8	56
2.8 TO 3.0	39
3.0 TO 3.5	59
3.5 TO 4.0	39
4.0 TO 4.5	25
OVER 4.5	76

TABLE 7 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 1.5 σ
2.0 - 2.6 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	42
10.0	TO	15.0	78
15.0	TO	20.0	44
20.0	TO	25.0	23
25.0	TO	30.0	16
30.0	TO	35.0	20
35.0	TO	40.0	14
40.0	TO	45.0	11
45.0	TO	50.0	11
50.0	TO	75.0	22
75.0	TO	100.0	16
100.0	TO	150.0	16
150.0	TO	200.0	6
200.0	TO	250.0	8
250.0	TO	300.0	2
300.0	TO	400.0	5
400.0	TO	500.0	3
	OVER	500.0	18

TOTAL NUMBER OF HOT SPOT = 355

854 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	15
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	27
17	TO	20	55	TO	65	36
20	TO	22	65	TO	72	34
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	23
26	TO	28	85	TO	91	22
28	TO	30	91	TO	98	20
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	45
39	TO	45	127	TO	147	22
45	TO	55	147	TO	180	23
55	TO	71	180	TO	232	18
71	TO	100	232	TO	328	21
OVER		100	OVER		328	49

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	6
1.2	TO	1.3	17
1.3	TO	1.4	26
1.4	TO	1.5	22
1.5	TO	1.6	51
1.6	TO	1.7	26
1.7	TO	1.8	38
1.8	TO	1.9	22
1.9	TO	2.0	22
2.0	TO	2.4	58
2.4	TO	2.6	14
2.6	TO	2.8	17
2.8	TO	3.0	9
3.0	TO	3.5	12
3.5	TO	4.0	8
4.0	TO	4.5	1
OVER		4.5	6

TABLE 7 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 2.0 σ
2.0 - 2.6 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	14
10.0	TO	15.0	21
15.0	TO	20.0	11
20.0	TO	25.0	12
25.0	TO	30.0	6
30.0	TO	35.0	9
35.0	TO	40.0	6
40.0	TO	45.0	5
45.0	TO	50.0	3
50.0	TO	75.0	7
75.0	TO	100.0	3
100.0	TO	150.0	3
150.0	TO	200.0	2
200.0	TO	250.0	1
250.0	TO	300.0	2
300.0	TO	400.0	2
400.0	TO	500.0	2
	OVER	500.0	5

TOTAL NUMBER OF HOT SPOT = 114

358 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	2
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	9
17	TO	20	55	TO	65	12
20	TO	22	65	TO	72	15
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	8
26	TO	28	85	TO	91	4
28	TO	30	91	TO	98	6
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	17
39	TO	45	127	TO	147	8
45	TO	55	147	TO	180	10
55	TO	71	180	TO	232	3
71	TO	100	232	TO	328	7
OVER		100	OVER		328	13

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	0
1.2	TO	1.3	3
1.3	TO	1.4	8
1.4	TO	1.5	7
1.5	TO	1.6	18
1.6	TO	1.7	15
1.7	TO	1.8	13
1.8	TO	1.9	9
1.9	TO	2.0	5
2.0	TO	2.4	23
2.4	TO	2.6	2
2.6	TO	2.8	5
2.8	TO	3.0	2
3.0	TO	3.5	3
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	1

TABLE 7 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 2.0 σ
4.5 - 5.5 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	21
10.0	TO	15.0	35
15.0	TO	20.0	19
20.0	TO	25.0	11
25.0	TO	30.0	8
30.0	TO	35.0	6
35.0	TO	40.0	6
40.0	TO	45.0	6
45.0	TO	50.0	3
50.0	TO	75.0	8
75.0	TO	100.0	3
100.0	TO	150.0	7
150.0	TO	200.0	6
200.0	TO	250.0	1
250.0	TO	300.0	2
300.0	TO	400.0	1
400.0	TO	500.0	2
	OVER	500.0	4

TOTAL NUMBER OF HOT SPOT = 149

241 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	10
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	17
17	TO	20	55	TO	65	20
20	TO	22	65	TO	72	13
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	10
26	TO	28	85	TO	91	9
28	TO	30	91	TO	98	9
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	12
39	TO	45	127	TO	147	6
45	TO	55	147	TO	180	10
55	TO	71	180	TO	232	9
71	TO	100	232	TO	328	7
OVER		100	OVER		328	17

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	3
1.2	TO	1.3	10
1.3	TO	1.4	16
1.4	TO	1.5	12
1.5	TO	1.6	21
1.6	TO	1.7	16
1.7	TO	1.8	12
1.8	TO	1.9	11
1.9	TO	2.0	7
2.0	TO	2.4	19
2.4	TO	2.6	6
2.6	TO	2.8	4
2.8	TO	3.0	3
3.0	TO	3.5	6
3.5	TO	4.0	3
4.0	TO	4.5	0
OVER		4.5	0

TABLE 7 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT (Threshold = Ave. + 2.5 σ, 4.5 - 5.5 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	3
10.0	TO	15.0	17
15.0	TO	20.0	16
20.0	TO	25.0	0
25.0	TO	30.0	1
30.0	TO	35.0	3
35.0	TO	40.0	3
40.0	TO	45.0	3
45.0	TO	50.0	3
50.0	TO	75.0	6
75.0	TO	100.0	1
100.0	TO	150.0	3
150.0	TO	200.0	2
200.0	TO	250.0	1
250.0	TO	300.0	1
300.0	TO	400.0	1
400.0	TO	500.0	1
	OVER	500.0	1

TOTAL NUMBER OF HOT SPOT = 66

74 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	1
14 TO 16	45 TO 52	0
16 TO 17	52 TO 55	5
17 TO 20	55 TO 65	5
20 TO 22	65 TO 72	9
22 TO 24	72 TO 78	0
24 TO 26	78 TO 85	9
26 TO 28	85 TO 91	4
28 TO 30	91 TO 98	1
30 TO 32	98 TO 104	0
32 TO 39	104 TO 127	7
39 TO 45	127 TO 147	4
45 TO 55	147 TO 180	5
55 TO 71	180 TO 232	6
71 TO 100	232 TO 328	1
OVER 100	OVER 328	9

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	0
1.2 TO 1.3	2
1.3 TO 1.4	6
1.4 TO 1.5	4
1.5 TO 1.6	8
1.6 TO 1.7	7
1.7 TO 1.8	9
1.8 TO 1.9	6
1.9 TO 2.0	3
2.0 TO 2.4	9
2.4 TO 2.6	2
2.6 TO 2.8	3
2.8 TO 3.0	2
3.0 TO 3.5	3
3.5 TO 4.0	1
4.0 TO 4.5	1
OVER 4.5	0

TABLE 7 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT BY AREA

(Threshold = Ave. + 3.0 σ 4.5 - 5.5 μm)

SQUARE METERS	FREQUENCY
0.0 TO 5.0	0
5.0 TO 10.0	3
10.0 TO 15.0	4
15.0 TO 20.0	2
20.0 TO 25.0	1
25.0 TO 30.0	0
30.0 TO 35.0	4
35.0 TO 40.0	0
40.0 TO 45.0	0
45.0 TO 50.0	0
50.0 TO 75.0	2
75.0 TO 100.0	0
100.0 TO 150.0	0
150.0 TO 200.0	0
200.0 TO 250.0	0
250.0 TO 300.0	0
300.0 TO 400.0	1
400.0 TO 500.0	0
OVER 500.0	0

TOTAL NUMBER OF HOT SPOT = 17

24 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	1
14 TO 16	45 TO 52	0
16 TO 17	52 TO 55	0
17 TO 20	55 TO 65	3
20 TO 22	65 TO 72	1
22 TO 24	72 TO 78	0
24 TO 26	78 TO 85	2
26 TO 28	85 TO 91	1
28 TO 30	91 TO 98	2
30 TO 32	98 TO 104	0
32 TO 39	104 TO 127	3
39 TO 45	127 TO 147	0
45 TO 55	147 TO 180	3
55 TO 71	180 TO 232	0
71 TO 100	232 TO 328	0
OVER 100	OVER 328	1

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	0
1.2 TO 1.3	1
1.3 TO 1.4	0
1.4 TO 1.5	1
1.5 TO 1.6	1
1.6 TO 1.7	2
1.7 TO 1.8	3
1.8 TO 1.9	0
1.9 TO 2.0	4
2.0 TO 2.4	3
2.4 TO 2.6	2
2.6 TO 2.8	0
2.8 TO 3.0	0
3.0 TO 3.5	0
3.5 TO 4.0	0
4.0 TO 4.5	0
OVER 4.5	0

TABLE 7 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 3.5 σ
4.5 - 5.5 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	0
10.0	TO	15.0	1
15.0	TO	20.0	0
20.0	TO	25.0	0
25.0	TO	30.0	0
30.0	TO	35.0	0
35.0	TO	40.0	0
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	0
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	1
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	0

TOTAL NUMBER OF HOT SPOT = 2

14 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	0
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	1
17	TO	20	55	TO	65	0
20	TO	22	65	TO	72	0
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	0
28	TO	30	91	TO	98	0
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	0
39	TO	45	127	TO	147	0
45	TO	55	147	TO	180	0
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	0
OVER		100	OVER		328	1

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	0
1.2	TO	1.3	0
1.3	TO	1.4	1
1.4	TO	1.5	0
1.5	TO	1.6	0
1.6	TO	1.7	0
1.7	TO	1.8	0
1.8	TO	1.9	0
1.9	TO	2.0	0
2.0	TO	2.4	0
2.4	TO	2.6	0
2.6	TO	2.8	1
2.8	TO	3.0	0
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	0

TABLE 7 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 2.0 σ
9.0 - 11.4 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	26
10.0	TO	15.0	47
15.0	TO	20.0	25
20.0	TO	25.0	18
25.0	TO	30.0	7
30.0	TO	35.0	14
35.0	TO	40.0	7
40.0	TO	45.0	7
45.0	TO	50.0	3
50.0	TO	75.0	14
75.0	TO	100.0	2
100.0	TO	150.0	7
150.0	TO	200.0	7
200.0	TO	250.0	1
250.0	TO	300.0	3
300.0	TO	400.0	2
400.0	TO	500.0	2
	OVER	500.0	5

TOTAL NUMBER OF HOT SPOT = 197

387 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	7
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	26
17	TO	20	55	TO	65	15
20	TO	22	65	TO	72	24
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	18
26	TO	28	85	TO	91	8
28	TO	30	91	TO	98	11
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	26
39	TO	45	127	TO	147	7
45	TO	55	147	TO	180	14
55	TO	71	180	TO	232	8
71	TO	100	232	TO	328	9
OVER		100	OVER		328	24

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	1
1.2	TO	1.3	8
1.3	TO	1.4	23
1.4	TO	1.5	9
1.5	TO	1.6	34
1.6	TO	1.7	16
1.7	TO	1.8	23
1.8	TO	1.9	10
1.9	TO	2.0	9
2.0	TO	2.4	31
2.4	TO	2.6	5
2.6	TO	2.8	7
2.8	TO	3.0	2
3.0	TO	3.5	12
3.5	TO	4.0	3
4.0	TO	4.5	4
OVER		4.5	0

TABLE 7 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 2.5 σ
9.0 - 11.4 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	9
10.0	TO	15.0	19
15.0	TO	20.0	7
20.0	TO	25.0	2
25.0	TO	30.0	4
30.0	TO	35.0	4
35.0	TO	40.0	2
40.0	TO	45.0	1
45.0	TO	50.0	2
50.0	TO	75.0	1
75.0	TO	100.0	1
100.0	TO	150.0	3
150.0	TO	200.0	1
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	2
400.0	TO	500.0	0
	OVER	500.0	1

TOTAL NUMBER OF HOT SPOT = 59

176 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	3
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	6
17	TO	20	55	TO	65	8
20	TO	22	65	TO	72	8
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	6
26	TO	28	85	TO	91	4
28	TO	30	91	TO	98	1
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	5
39	TO	45	127	TO	147	4
45	TO	55	147	TO	180	4
55	TO	71	180	TO	232	4
71	TO	100	232	TO	328	1
OVER		100	OVER		328	5

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	0
1.2	TO	1.3	5
1.3	TO	1.4	2
1.4	TO	1.5	4
1.5	TO	1.6	6
1.6	TO	1.7	7
1.7	TO	1.8	14
1.8	TO	1.9	3
1.9	TO	2.0	4
2.0	TO	2.4	5
2.4	TO	2.6	2
2.6	TO	2.8	2
2.8	TO	3.0	2
3.0	TO	3.5	1
3.5	TO	4.0	1
4.0	TO	4.5	0
	OVER	4.5	1

TABLE 7 (Concluded)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 3.0 σ
9.0 - 11.4 μm)

BY AREA

SQUARE METERS	FREQUENCY
0.0 TO 5.0	0
5.0 TO 10.0	1
10.0 TO 15.0	2
15.0 TO 20.0	2
20.0 TO 25.0	0
25.0 TO 30.0	0
30.0 TO 35.0	1
35.0 TO 40.0	1
40.0 TO 45.0	1
45.0 TO 50.0	1
50.0 TO 75.0	1
75.0 TO 100.0	0
100.0 TO 150.0	0
150.0 TO 200.0	0
200.0 TO 250.0	1
250.0 TO 300.0	0
300.0 TO 400.0	0
400.0 TO 500.0	0
OVER 500.0	0

TOTAL NUMBER OF HOT SPOT = 11

22 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	0
14 TO 16	45 TO 52	0
16 TO 17	52 TO 55	0
17 TO 20	55 TO 65	1
20 TO 22	65 TO 72	3
22 TO 24	72 TO 78	0
24 TO 26	78 TO 85	0
26 TO 28	85 TO 91	0
28 TO 30	91 TO 98	1
30 TO 32	98 TO 104	0
32 TO 39	104 TO 127	0
39 TO 45	127 TO 147	2
45 TO 55	147 TO 180	1
55 TO 71	180 TO 232	0
71 TO 100	232 TO 328	2
OVER 100	OVER 328	1

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	0
1.2 TO 1.3	0
1.3 TO 1.4	0
1.4 TO 1.5	2
1.5 TO 1.6	0
1.6 TO 1.7	0
1.7 TO 1.8	0
1.8 TO 1.9	3
1.9 TO 2.0	0
2.0 TO 2.4	2
2.4 TO 2.6	0
2.6 TO 2.8	1
2.8 TO 3.0	1
3.0 TO 3.5	2
3.5 TO 4.0	0
4.0 TO 4.5	0
OVER 4.5	0

TABLE 8

HUME2 - Total Scene
AREA DISTRIBUTIONS

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 1.0 σ
2.0 - 2.6 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	56
10.0	TO	15.0	45
15.0	TO	20.0	62
20.0	TO	25.0	28
25.0	TO	30.0	11
30.0	TO	35.0	17
35.0	TO	40.0	6
40.0	TO	45.0	10
45.0	TO	50.0	5
50.0	TO	75.0	23
75.0	TO	100.0	16
100.0	TO	150.0	23
150.0	TO	200.0	8
200.0	TO	250.0	2
250.0	TO	300.0	1
300.0	TO	400.0	2
400.0	TO	500.0	1
	OVER	500.0	10

TOTAL NUMBER OF HOT SPOT = 326

300 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	25
14	TO	16	45	TO	52	43
16	TO	17	52	TO	55	1
17	TO	20	55	TO	65	66
20	TO	22	65	TO	72	13
22	TO	24	72	TO	78	16
24	TO	26	78	TO	85	15
26	TO	28	85	TO	91	19
28	TO	30	91	TO	98	15
30	TO	32	98	TO	104	3
32	TO	39	104	TO	127	14
39	TO	45	127	TO	147	20
45	TO	55	147	TO	180	10
55	TO	71	180	TO	232	16
71	TO	100	232	TO	328	11
OVER		100	OVER		328	39

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	43
1.2	TO	1.3	42
1.3	TO	1.4	58
1.4	TO	1.5	25
1.5	TO	1.6	30
1.6	TO	1.7	31
1.7	TO	1.8	22
1.8	TO	1.9	7
1.9	TO	2.0	6
2.0	TO	2.4	22
2.4	TO	2.6	4
2.6	TO	2.8	6
2.8	TO	3.0	8
3.0	TO	3.5	17
3.5	TO	4.0	3
4.0	TO	4.5	1
	OVER	4.5	1

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT
BY AREA

$\left(\begin{array}{c}\text{Threshold} = \text{Ave.} + 1.5\ \sigma \\ 2.0 - 2.6\ \mu m\end{array}\right)$

SQUARE METERS	FREQUENCY
0.0 TO 5.0	0
5.0 TO 10.0	51
10.0 TO 15.0	33
15.0 TO 20.0	32
20.0 TO 25.0	25
25.0 TO 30.0	8
30.0 TO 35.0	8
35.0 TO 40.0	4
40.0 TO 45.0	2
45.0 TO 50.0	7
50.0 TO 75.0	15
75.0 TO 100.0	6
100.0 TO 150.0	4
150.0 TO 200.0	5
200.0 TO 250.0	0
250.0 TO 300.0	1
300.0 TO 400.0	0
400.0 TO 500.0	3
OVER 500.0	4

TOTAL NUMBER OF HOT SPOT = 208

311 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	28
14 TO 16	45 TO 52	32
16 TO 17	52 TO 55	0
17 TO 20	55 TO 65	38
20 TO 22	65 TO 72	3
22 TO 24	72 TO 78	18
24 TO 26	78 TO 85	12
26 TO 28	85 TO 91	4
28 TO 30	91 TO 98	7
30 TO 32	98 TO 104	6
32 TO 39	104 TO 127	13
39 TO 45	127 TO 147	13
45 TO 55	147 TO 180	9
55 TO 71	180 TO 232	8
71 TO 100	232 TO 328	7
OVER 100	OVER 328	10

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	33
1.2 TO 1.3	21
1.3 TO 1.4	52
1.4 TO 1.5	19
1.5 TO 1.6	10
1.6 TO 1.7	22
1.7 TO 1.8	12
1.8 TO 1.9	8
1.9 TO 2.0	6
2.0 TO 2.4	15
2.4 TO 2.6	1
2.6 TO 2.8	1
2.8 TO 3.0	3
3.0 TO 3.5	3
3.5 TO 4.0	1
4.0 TO 4.5	0
OVER 4.5	1

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 2.0 σ
2.0 - 2.6 μm)

SQUARE METERS	FREQUENCY
0.0 TO 5.0	0
5.0 TO 10.0	36
10.0 TO 15.0	25
15.0 TO 20.0	20
20.0 TO 25.0	9
25.0 TO 30.0	6
30.0 TO 35.0	9
35.0 TO 40.0	1
40.0 TO 45.0	7
45.0 TO 50.0	2
50.0 TO 75.0	4
75.0 TO 100.0	7
100.0 TO 150.0	3
150.0 TO 200.0	2
200.0 TO 250.0	0
250.0 TO 300.0	0
300.0 TO 400.0	2
400.0 TO 500.0	0
OVER 500.0	4

TOTAL NUMBER OF HOT SPOT = 137

180 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	17
14 TO 16	45 TO 52	22
16 TO 17	52 TO 55	1
17 TO 20	55 TO 65	30
20 TO 22	65 TO 72	6
22 TO 24	72 TO 78	6
24 TO 26	78 TO 85	5
26 TO 28	85 TO 91	6
28 TO 30	91 TO 98	3
30 TO 32	98 TO 104	1
32 TO 39	104 TO 127	10
39 TO 45	127 TO 147	8
45 TO 55	147 TO 180	6
55 TO 71	180 TO 232	5
71 TO 100	[illegible]2 TO 328	4
OVER 100	OVER 328	7

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	22
1.2 TO 1.3	12
1.3 TO 1.4	37
1.4 TO 1.5	10
1.5 TO 1.6	15
1.6 TO 1.7	8
1.7 TO 1.8	9
1.8 TO 1.9	3
1.9 TO 2.0	5
2.0 TO 2.4	10
2.4 TO 2.6	3
2.6 TO 2.8	2
2.8 TO 3.0	0
3.0 TO 3.5	0
3.5 TO 4.0	0
4.0 TO 4.5	0
OVER 4.5	1

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 1.0 σ
3.0 - 4.2 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	513
10.0	TO	15.0	256
15.0	TO	20.0	237
20.0	TO	25.0	101
25.0	TO	30.0	21
30.0	TO	35.0	38
35.0	TO	40.0	15
40.0	TO	45.0	20
45.0	TO	50.0	15
50.0	TO	75.0	31
75.0	TO	100.0	20
100.0	TO	150.0	13
150.0	TO	200.0	4
200.0	TO	250.0	5
250.0	TO	300.0	1
300.0	TO	400.0	1
400.0	TO	500.0	2
	OVER	500.0	5

TOTAL NUMBER OF HOT SPOT = 1298

4425 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	301
14	TO	16	45	TO	52	239
16	TO	17	52	TO	55	4
17	TO	20	55	TO	65	336
20	TO	22	65	TO	72	52
22	TO	24	72	TO	78	48
24	TO	26	78	TO	85	70
26	TO	28	85	TO	91	23
28	TO	30	91	TO	98	39
30	TO	32	98	TO	104	15
32	TO	39	104	TO	127	47
39	TO	45	127	TO	147	34
45	TO	55	147	TO	180	28
55	TO	71	180	TO	232	21
71	TO	100	232	TO	328	25
OVER		100	OVER		328	16

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	326
1.2	TO	1.3	160
1.3	TO	1.4	302
1.4	TO	1.5	101
1.5	TO	1.6	118
1.6	TO	1.7	79
1.7	TO	1.8	62
1.8	TO	1.9	31
1.9	TO	2.0	33
2.0	TO	2.4	57
2.4	TO	2.6	12
2.6	TO	2.8	7
2.8	TO	3.0	3
3.0	TO	3.5	1
3.5	TO	4.0	2
4.0	TO	4.5	1
OVER		4.5	3

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 1.5 σ
3.0 - 4.2 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	39
10.0	TO	15.0	21
15.0	TO	20.0	29
20.0	TO	25.0	14
25.0	TO	30.0	8
30.0	TO	35.0	5
35.0	TO	40.0	3
40.0	TO	45.0	3
45.0	TO	50.0	3
50.0	TO	75.0	8
75.0	TO	100.0	2
100.0	TO	150.0	2
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	1
300.0	TO	400.0	1
400.0	TO	500.0	0
	OVER	500.0	4

TOTAL NUMBER OF HOT SPOT = 143

229 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	27
14	TO	16	45	TO	52	16
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	35
20	TO	22	65	TO	72	6
22	TO	24	72	TO	78	8
24	TO	26	78	TO	85	5
26	TO	28	85	TO	91	7
28	TO	30	91	TO	98	7
30	TO	32	98	TO	104	2
32	TO	39	104	TO	127	11
39	TO	45	127	TO	147	8
45	TO	55	147	TO	180	2
55	TO	71	180	TO	232	1
71	TO	100	232	TO	328	3
OVER		100	OVER		328	5

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	32
1.2	TO	1.3	16
1.3	TO	1.4	40
1.4	TO	1.5	8
1.5	TO	1.6	17
1.6	TO	1.7	8
1.7	TO	1.8	7
1.8	TO	1.9	4
1.9	TO	2.0	4
2.0	TO	2.4	3
2.4	TO	2.6	1
2.6	TO	2.8	1
2.8	TO	3.0	0
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	2

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 0.5 σ
4.5 - 5.5 μm)

BY AREA

SQUARE METERS	FREQUENCY
0.0 TO 5.0	0
5.0 TO 10.0	101
10.0 TO 15.0	56
15.0 TO 20.0	84
20.0 TO 25.0	50
25.0 TO 30.0	19
30.0 TO 35.0	44
35.0 TO 40.0	20
40.0 TO 45.0	25
45.0 TO 50.0	18
50.0 TO 75.0	60
75.0 TO 100.0	35
100.0 TO 150.0	40
150.0 TO 200.0	21
200.0 TO 250.0	20
250.0 TO 300.0	18
300.0 TO 400.0	32
400.0 TO 500.0	17
OVER 500.0	53

TOTAL NUMBER OF HOT SPOT = 713

485 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	19
14 TO 16	45 TO 52	79
16 TO 17	52 TO 55	4
17 TO 20	55 TO 65	87
20 TO 22	65 TO 72	29
22 TO 24	72 TO 78	12
24 TO 26	78 TO 85	33
26 TO 28	85 TO 91	22
28 TO 30	91 TO 98	30
30 TO 32	98 TO 104	13
32 TO 39	104 TO 127	55
39 TO 45	127 TO 147	47
45 TO 55	147 TO 180	42
55 TO 71	180 TO 232	54
71 TO 100	232 TO 328	47
OVER 100	OVER 328	140

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	44
1.2 TO 1.3	41
1.3 TO 1.4	134
1.4 TO 1.5	52
1.5 TO 1.6	64
1.6 TO 1.7	56
1.7 TO 1.8	55
1.8 TO 1.9	33
1.9 TO 2.0	41
2.0 TO 2.4	120
2.4 TO 2.6	19
2.6 TO 2.8	11
2.8 TO 3.0	9
3.0 TO 3.5	6
3.5 TO 4.0	7
4.0 TO 4.5	3
OVER 4.5	18

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 1.0 σ
4.5 - 5.5 μm)

SQUARE METERS	FREQUENCY
0.0 TO 5.0	0
5.0 TO 10.0	120
10.0 TO 15.0	70
15.0 TO 20.0	117
20.0 TO 25.0	55
25.0 TO 30.0	30
30.0 TO 35.0	41
35.0 TO 40.0	16
40.0 TO 45.0	22
45.0 TO 50.0	32
50.0 TO 75.0	67
75.0 TO 100.0	49
100.0 TO 150.0	52
150.0 TO 200.0	39
200.0 TO 250.0	36
250.0 TO 300.0	16
300.0 TO 400.0	24
400.0 TO 500.0	12
OVER 500.0	68

TOTAL NUMBER OF HOT SPOT = 866

659 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	35
14 TO 16	45 TO 52	61
16 TO 17	52 TO 55	2
17 TO 20	55 TO 65	134
20 TO 22	65 TO 72	38
22 TO 24	72 TO 78	12
24 TO 26	78 TO 85	28
26 TO 28	85 TO 91	41
28 TO 30	91 TO 98	36
30 TO 32	98 TO 104	22
32 TO 39	104 TO 127	57
39 TO 45	127 TO 147	37
45 TO 55	147 TO 180	60
55 TO 71	180 TO 232	64
71 TO 100	232 TO 328	67
OVER 100	OVER 328	172

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	45
1.2 TO 1.3	44
1.3 TO 1.4	137
1.4 TO 1.5	76
1.5 TO 1.6	81
1.6 TO 1.7	71
1.7 TO 1.8	70
1.8 TO 1.9	46
1.9 TO 2.0	56
2.0 TO 2.4	117
2.4 TO 2.6	28
2.6 TO 2.8	16
2.8 TO 3.0	18
3.0 TO 3.5	23
3.5 TO 4.0	7
4.0 TO 4.5	6
OVER 4.5	25

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

$\left(\begin{array}{c}\text{Threshold = Ave. + 2.0 } \sigma \\ 4.5 - 5.5\ \mu\text{m}\end{array}\right)$

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	19
10.0	TO	15.0	10
15.0	TO	20.0	26
20.0	TO	25.0	10
25.0	TO	30.0	7
30.0	TO	35.0	12
35.0	TO	40.0	4
40.0	TO	45.0	3
45.0	TO	50.0	2
50.0	TO	75.0	11
75.0	TO	100.0	3
100.0	TO	150.0	5
150.0	TO	200.0	3
200.0	TO	250.0	0
250.0	TO	300.0	2
300.0	TO	400.0	1
400.0	TO	500.0	1
	OVER	500.0	8

TOTAL NUMBER OF HOT SPOT = 127

110 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	5
14	TO	16	45	TO	52	15
16	TO	17	52	TO	55	1
17	TO	20	55	TO	65	15
20	TO	22	65	TO	72	12
22	TO	24	72	TO	78	7
24	TO	26	78	TO	85	6
26	TO	28	85	TO	91	5
28	TO	30	91	TO	98	3
30	TO	32	98	TO	104	3
32	TO	39	104	TO	127	14
39	TO	45	127	TO	147	5
45	TO	55	147	TO	180	8
55	TO	71	180	TO	232	8
71	TO	100	232	TO	328	6
OVER		100	OVER		328	14

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	9
1.2	TO	1.3	7
1.3	TO	1.4	24
1.4	TO	1.5	12
1.5	TO	1.6	13
1.6	TO	1.7	14
1.7	TO	1.8	7
1.8	TO	1.9	6
1.9	TO	2.0	5
2.0	TO	2.4	14
2.4	TO	2.6	3
2.6	TO	2.8	5
2.8	TO	3.0	0
3.0	TO	3.5	3
3.5	TO	4.0	2
4.0	TO	4.5	0
	OVER	4.5	3

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 2.5 σ
4.5 - 5.5 μm)

SQUARE METERS	FREQUENCY
0.0 TO 5.0	0
5.0 TO 10.0	12
10.0 TO 15.0	2
15.0 TO 20.0	11
20.0 TO 25.0	3
25.0 TO 30.0	3
30.0 TO 35.0	5
35.0 TO 40.0	1
40.0 TO 45.0	1
45.0 TO 50.0	1
50.0 TO 75.0	2
75.0 TO 100.0	0
100.0 TO 150.0	3
150.0 TO 200.0	0
200.0 TO 250.0	0
250.0 TO 300.0	3
300.0 TO 400.0	1
400.0 TO 500.0	1
OVER 500.0	2

TOTAL NUMBER OF HOT SPOT = 51

53 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	6
14 TO 16	45 TO 52	4
16 TO 17	52 TO 55	0
17 TO 20	55 TO 65	5
20 TO 22	65 TO 72	5
22 TO 24	72 TO 78	2
24 TO 26	78 TO 85	3
26 TO 28	85 TO 91	2
28 TO 30	91 TO 98	2
30 TO 32	98 TO 104	1
32 TO 39	104 TO 127	6
39 TO 45	127 TO 147	2
45 TO 55	147 TO 180	2
55 TO 71	180 TO 232	1
71 TO 100	232 TO 328	3
OVER 100	OVER 328	7

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	6
1.2 TO 1.3	4
1.3 TO 1.4	4
1.4 TO 1.5	2
1.5 TO 1.6	9
1.6 TO 1.7	3
1.7 TO 1.8	4
1.8 TO 1.9	3
1.9 TO 2.0	1
2.0 TO 2.4	7
2.4 TO 2.6	1
2.6 TO 2.8	2
2.8 TO 3.0	1
3.0 TO 3.5	1
3.5 TO 4.0	1
4.0 TO 4.5	1
OVER 4.5	1

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT (Threshold = Ave. + 3.0 σ 4.5 - 5.5 μm)

BY AREA

SQUARE METERS	FREQUENCY
0.0 TO 5.0	0
5.0 TO 10.0	5
10.0 TO 15.0	2
15.0 TO 20.0	4
20.0 TO 25.0	5
25.0 TO 30.0	0
30.0 TO 35.0	0
35.0 TO 40.0	0
40.0 TO 45.0	1
45.0 TO 50.0	0
50.0 TO 75.0	0
75.0 TO 100.0	1
100.0 TO 150.0	0
150.0 TO 200.0	0
200.0 TO 250.0	0
250.0 TO 300.0	0
300.0 TO 400.0	0
400.0 TO 500.0	0
OVER 500.0	0

TOTAL NUMBER OF HOT SPOT = 18

23 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	0
14 TO 16	45 TO 52	5
16 TO 17	52 TO 55	0
17 TO 20	55 TO 65	3
20 TO 22	65 TO 72	0
22 TO 24	72 TO 78	4
24 TO 26	78 TO 85	0
26 TO 28	85 TO 91	2
28 TO 30	91 TO 98	0
30 TO 32	98 TO 104	1
32 TO 39	104 TO 127	1
39 TO 45	127 TO 147	0
45 TO 55	147 TO 180	0
55 TO 71	180 TO 232	1
71 TO 100	232 TO 328	1
OVER 100	OVER 328	0

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	1
1.2 TO 1.3	1
1.3 TO 1.4	6
1.4 TO 1.5	2
1.5 TO 1.6	3
1.6 TO 1.7	0
1.7 TO 1.8	2
1.8 TO 1.9	0
1.9 TO 2.0	0
2.0 TO 2.4	2
2.4 TO 2.6	0
2.6 TO 2.8	0
2.8 TO 3.0	1
3.0 TO 3.5	0
3.5 TO 4.0	0
4.0 TO 4.5	0
OVER 4.5	0

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 0.5 σ
9.0 - 11.4 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	111
10.0	TO	15.0	77
15.0	TO	20.0	98
20.0	TO	25.0	62
25.0	TO	30.0	32
30.0	TO	35.0	35
35.0	TO	40.0	19
40.0	TO	45.0	24
45.0	TO	50.0	24
50.0	TO	75.0	64
75.0	TO	100.0	29
100.0	TO	150.0	34
150.0	TO	200.0	25
200.0	TO	250.0	24
250.0	TO	300.0	12
300.0	TO	400.0	32
400.0	TO	500.0	22
	OVER	500.0	43

TOTAL NUMBER OF HOT SPOT = 767

629 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	17
14	TO	16	45	TO	52	82
16	TO	17	52	TO	55	3
17	TO	20	55	TO	65	102
20	TO	22	65	TO	72	44
22	TO	24	72	TO	78	9
24	TO	26	78	TO	85	35
26	TO	28	85	TO	91	31
28	TO	30	91	TO	98	33
30	TO	32	98	TO	104	25
32	TO	39	104	TO	127	58
39	TO	45	127	TO	147	48
45	TO	55	147	TO	180	40
55	TO	71	180	TO	232	57
71	TO	100	232	TO	328	42
OVER		100	OVER		328	141

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	38
1.2	TO	1.3	37
1.3	TO	1.4	117
1.4	TO	1.5	71
1.5	TO	1.6	83
1.6	TO	1.7	63
1.7	TO	1.8	64
1.8	TO	1.9	39
1.9	TO	2.0	45
2.0	TO	2.4	112
2.4	TO	2.6	27
2.6	TO	2.8	20
2.8	TO	3.0	7
3.0	TO	3.5	24
3.5	TO	4.0	4
4.0	TO	4.5	4
	OVER	4.5	12

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 1.0 σ
9.0 - 11.4 μm)

SQUARE METERS	FREQUENCY
0.0 TO 5.0	0
5.0 TO 10.0	146
10.0 TO 15.0	105
15.0 TO 20.0	130
20.0 TO 25.0	77
25.0 TO 30.0	29
30.0 TO 35.0	61
35.0 TO 40.0	28
40.0 TO 45.0	35
45.0 TO 50.0	30
50.0 TO 75.0	82
75.0 TO 100.0	56
100.0 TO 150.0	68
150.0 TO 200.0	37
200.0 TO 250.0	43
250.0 TO 300.0	27
300.0 TO 400.0	25
400.0 TO 500.0	14
OVER 500.0	70

TOTAL NUMBER OF HOT SPOT = 1063

782 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	37
14 TO 16	45 TO 52	104
16 TO 17	52 TO 55	5
17 TO 20	55 TO 65	152
20 TO 22	65 TO 72	40
22 TO 24	72 TO 78	18
24 TO 26	78 TO 85	33
26 TO 28	85 TO 91	38
28 TO 30	91 TO 98	39
30 TO 32	98 TO 104	32
32 TO 39	104 TO 127	77
39 TO 45	127 TO 147	62
45 TO 55	147 TO 180	72
55 TO 71	180 TO 232	70
71 TO 100	232 TO 328	78
OVER 100	OVER 328	206

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	63
1.2 TO 1.3	54
1.3 TO 1.4	166
1.4 TO 1.5	65
1.5 TO 1.6	117
1.6 TO 1.7	79
1.7 TO 1.8	84
1.8 TO 1.9	53
1.9 TO 2.0	55
2.0 TO 2.4	155
2.4 TO 2.6	36
2.6 TO 2.8	32
2.8 TO 3.0	22
3.0 TO 3.5	34
3.5 TO 4.0	16
4.0 TO 4.5	8
OVER 4.5	24

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

$\left(\begin{array}{c}\text{Threshold = Ave. + 1.5 } \sigma \\ 9.0 - 11.4\ \mu\text{m}\end{array}\right)$

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	61
10.0	TO	15.0	40
15.0	TO	20.0	53
20.0	TO	25.0	46
25.0	TO	30.0	13
30.0	TO	35.0	23
35.0	TO	40.0	9
40.0	TO	45.0	19
45.0	TO	50.0	13
50.0	TO	75.0	24
75.0	TO	100.0	13
100.0	TO	150.0	17
150.0	TO	200.0	15
200.0	TO	250.0	7
250.0	TO	300.0	12
300.0	TO	400.0	7
400.0	TO	500.0	3
	OVER	500.0	22

TOTAL NUMBER OF HOT SPOT = 397

361 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	19
14	TO	16	45	TO	52	36
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	69
20	TO	22	65	TO	72	18
22	TO	24	72	TO	78	8
24	TO	26	78	TO	85	19
26	TO	28	85	TO	91	14
28	TO	30	91	TO	98	17
30	TO	32	98	TO	104	15
32	TO	39	104	TO	127	22
39	TO	45	127	TO	147	26
45	TO	55	147	TO	180	28
55	TO	71	180	TO	232	23
71	TO	100	232	TO	328	20
OVER		100	OVER		328	63

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	30
1.2	TO	1.3	25
1.3	TO	1.4	63
1.4	TO	1.5	24
1.5	TO	1.6	37
1.6	TO	1.7	34
1.7	TO	1.8	35
1.8	TO	1.9	23
1.9	TO	2.0	18
2.0	TO	2.4	58
2.4	TO	2.6	13
2.6	TO	2.8	8
2.8	TO	3.0	9
3.0	TO	3.5	11
3.5	TO	4.0	5
4.0	TO	4.5	0
	OVER	4.5	4

AD-A077 025 ENVIRONMENTAL RESEARCH INST OF MICHIGAN ANN ARBOR IN--ETC F/G 17/
STATISTICAL ANALYSIS OF TERRAIN AND WATER BACKGROUNDS IN THE VI--ETC
APR 79 A J LAROCCA N60530-78-C-0009
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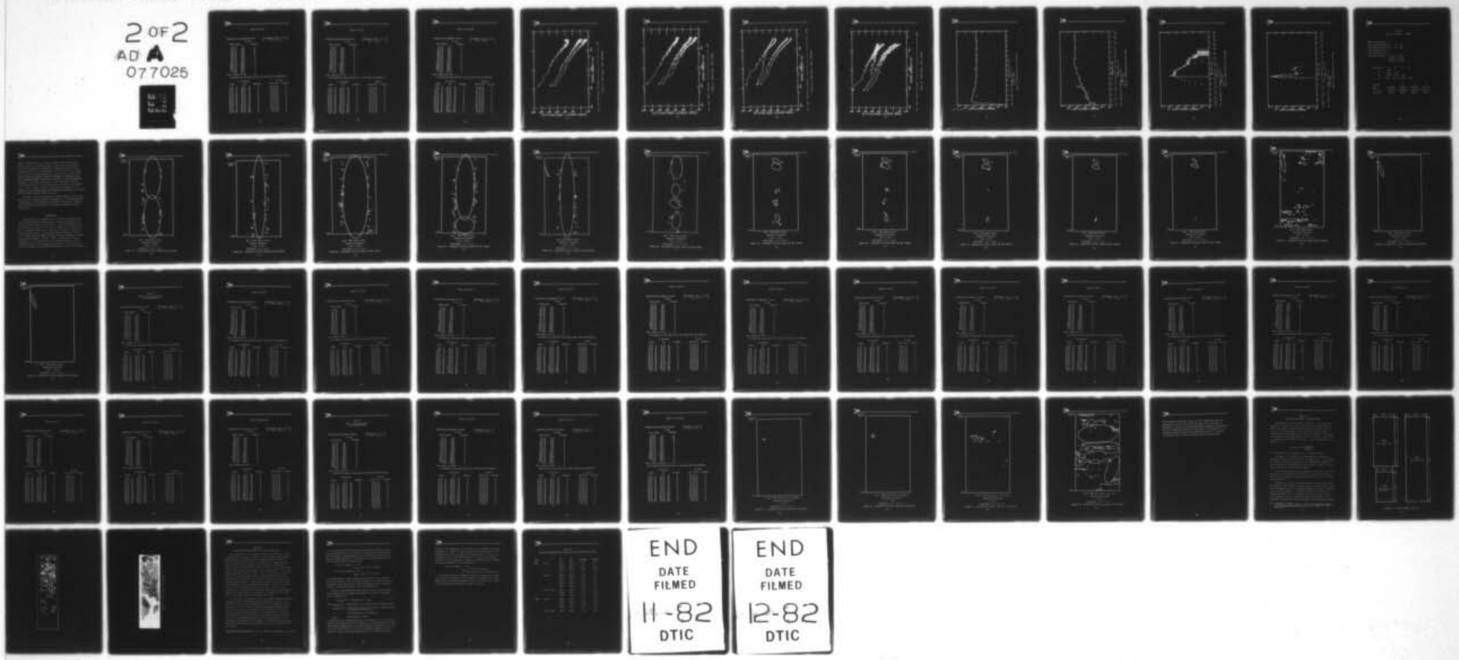


TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 2.0 σ
9.0 - 11.4 μm)

BY AREA

SQUARE METERS	FREQUENCY
0.0 TO 5.0	0
5.0 TO 10.0	19
10.0 TO 15.0	6
15.0 TO 20.0	10
20.0 TO 25.0	12
25.0 TO 30.0	5
30.0 TO 35.0	2
35.0 TO 40.0	2
40.0 TO 45.0	1
45.0 TO 50.0	3
50.0 TO 75.0	3
75.0 TO 100.0	3
100.0 TO 150.0	4
150.0 TO 200.0	2
200.0 TO 250.0	0
250.0 TO 300.0	1
300.0 TO 400.0	0
400.0 TO 500.0	4
OVER 500.0	5

TOTAL NUMBER OF HOT SPOT = 82

48 FEATURES WITH AREAS LESS THAN 5.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	8
14 TO 16	45 TO 52	9
16 TO 17	52 TO 55	0
17 TO 20	55 TO 65	13
20 TO 22	65 TO 72	2
22 TO 24	72 TO 78	4
24 TO 26	78 TO 85	5
26 TO 28	85 TO 91	2
28 TO 30	91 TO 98	3
30 TO 32	98 TO 104	2
32 TO 39	104 TO 127	4
39 TO 45	127 TO 147	5
45 TO 55	147 TO 180	5
55 TO 71	180 TO 232	3
71 TO 100	232 TO 328	3
OVER 100	OVER 328	14

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	8
1.2 TO 1.3	2
1.3 TO 1.4	17
1.4 TO 1.5	9
1.5 TO 1.6	5
1.6 TO 1.7	3
1.7 TO 1.8	7
1.8 TO 1.9	3
1.9 TO 2.0	5
2.0 TO 2.4	12
2.4 TO 2.6	1
2.6 TO 2.8	3
2.8 TO 3.0	2
3.0 TO 3.5	4
3.5 TO 4.0	1
4.0 TO 4.5	0
OVER 4.5	0

TABLE 8 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT BY AREA

(Threshold = Ave. + 2.5 σ 9.0 - 11.4 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	2
10.0	TO	15.0	0
15.0	TO	20.0	2
20.0	TO	25.0	1
25.0	TO	30.0	0
30.0	TO	35.0	0
35.0	TO	40.0	1
40.0	TO	45.0	1
45.0	TO	50.0	1
50.0	TO	75.0	0
75.0	TO	100.0	0
100.0	TO	150.0	1
150.0	TO	200.0	1
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	3

TOTAL NUMBER OF HOT SPOT = 13

19 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	0
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	2
20	TO	22	65	TO	72	2
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	1
26	TO	28	85	TO	91	0
28	TO	30	91	TO	98	0
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	0
39	TO	45	127	TO	147	0
45	TO	55	147	TO	180	1
55	TO	71	180	TO	232	3
71	TO	100	232	TO	328	0
OVER		100	OVER		328	4

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	0
1.2	TO	1.3	0
1.3	TO	1.4	0
1.4	TO	1.5	1
1.5	TO	1.6	3
1.6	TO	1.7	0
1.7	TO	1.8	2
1.8	TO	1.9	0
1.9	TO	2.0	0
2.0	TO	2.4	1
2.4	TO	2.6	0
2.6	TO	2.8	2
2.8	TO	3.0	1
3.0	TO	3.5	0
3.5	TO	4.0	2
4.0	TO	4.5	0
	OVER	4.5	1

TABLE 8 (Concluded)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 3.0 σ
9.0 - 11.4 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	1
10.0	TO	15.0	1
15.0	TO	20.0	2
20.0	TO	25.0	1
25.0	TO	30.0	0
30.0	TO	35.0	0
35.0	TO	40.0	0
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	1
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	0

TOTAL NUMBER OF HOT SPOT = 6

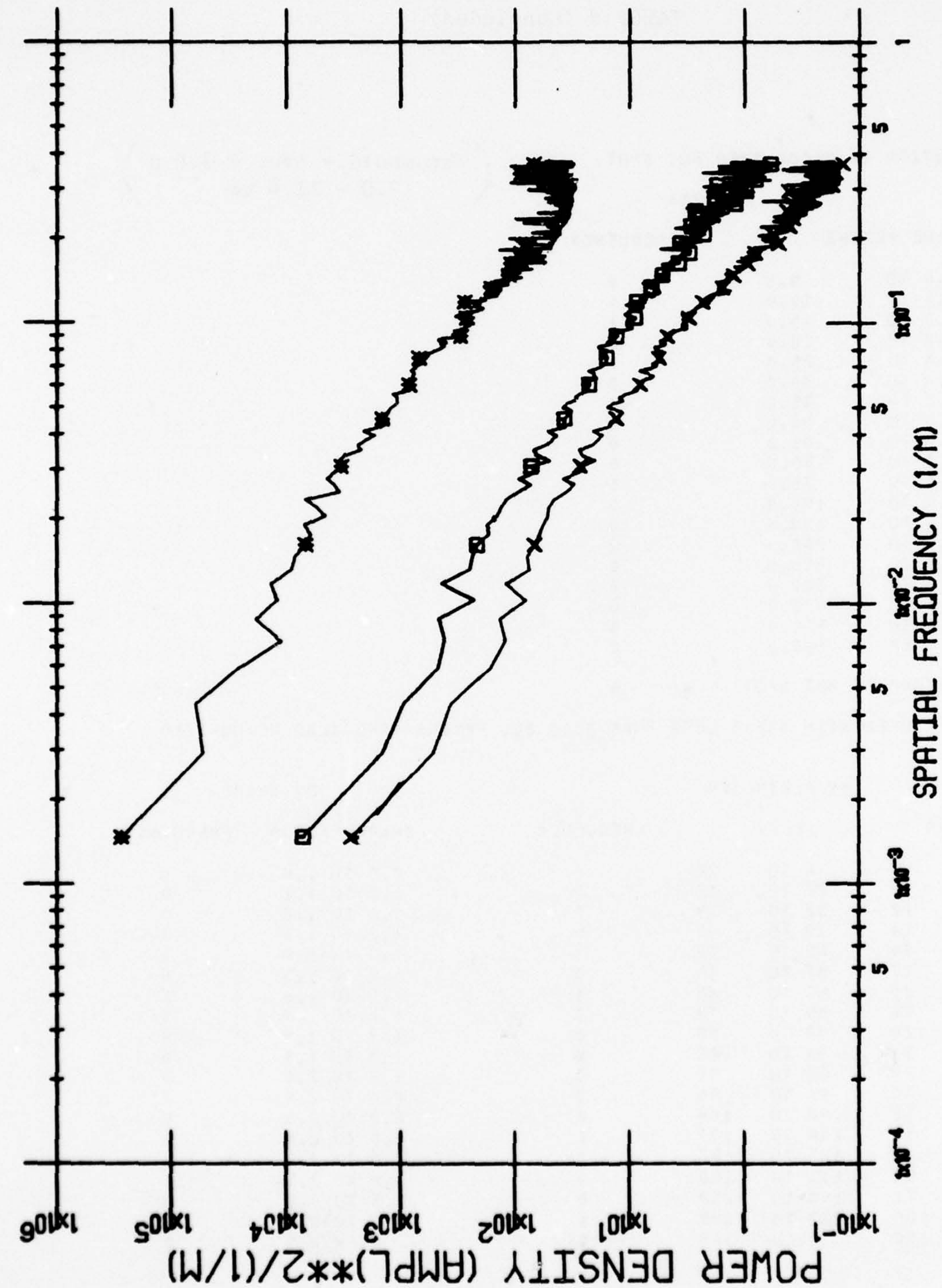
3 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	0
14	TO	16	45	TO	52	1
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	1
20	TO	22	65	TO	72	0
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	0
28	TO	30	91	TO	98	2
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	0
39	TO	45	127	TO	147	1
45	TO	55	147	TO	180	0
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	1
OVER		100		OVER	328	0

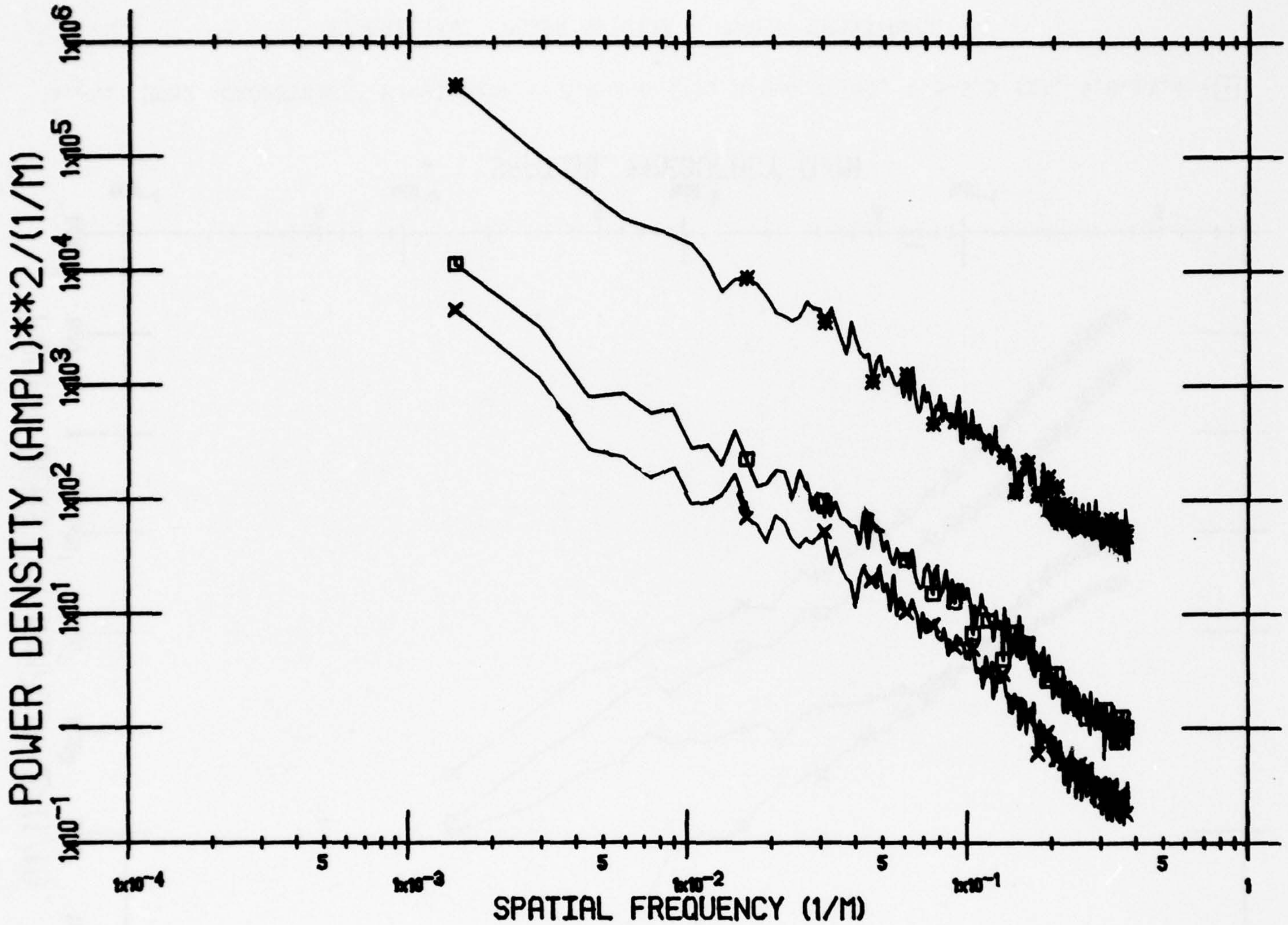
BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	0
1.2	TO	1.3	0
1.3	TO	1.4	1
1.4	TO	1.5	0
1.5	TO	1.6	1
1.6	TO	1.7	0
1.7	TO	1.8	0
1.8	TO	1.9	0
1.9	TO	2.0	0
2.0	TO	2.4	3
2.4	TO	2.6	0
2.6	TO	2.8	0
2.8	TO	3.0	0
3.0	TO	3.5	1
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	0



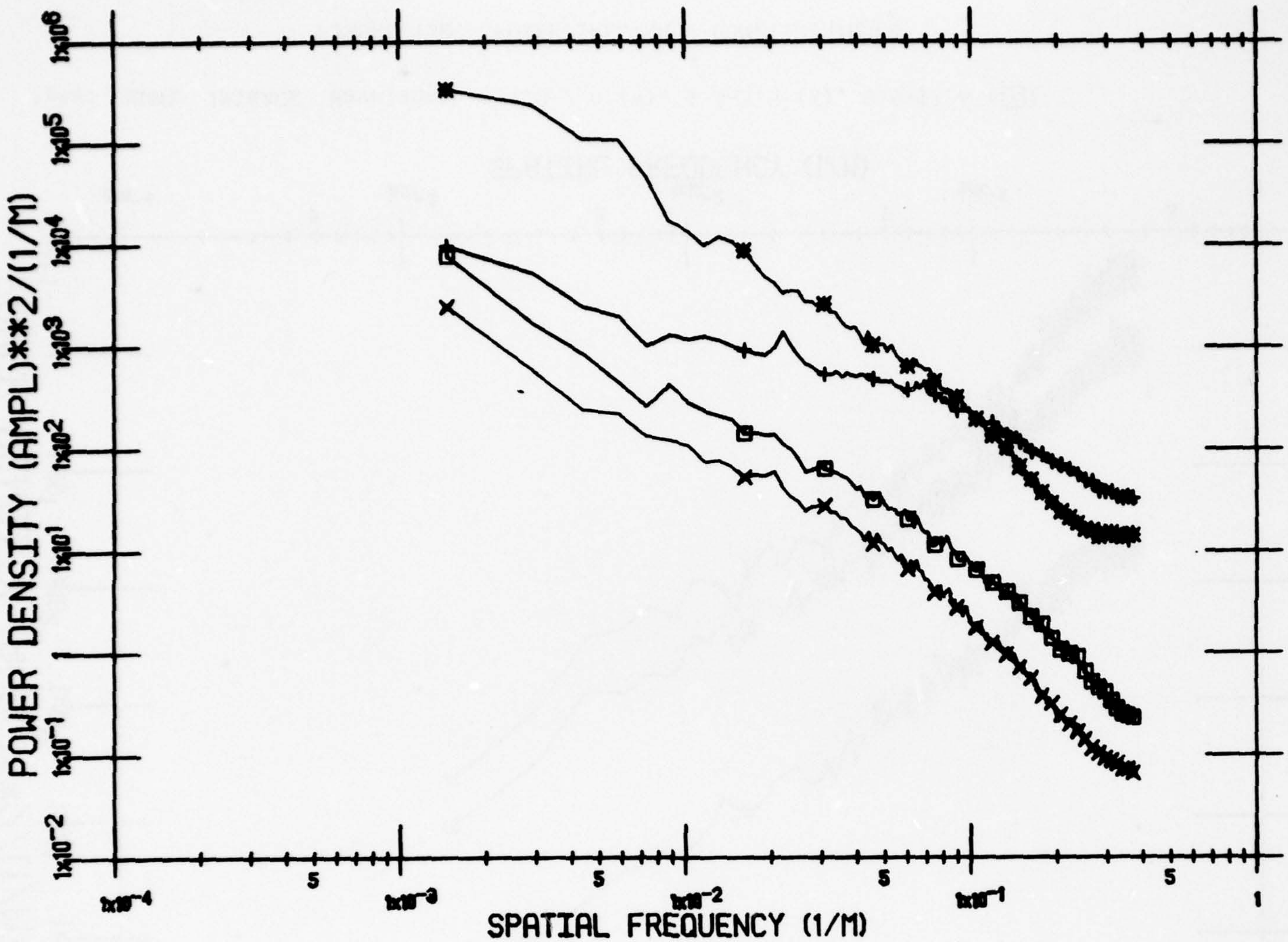
Area: HUM1 CROSSTRACK Wavelength = 2.0-2.6 (*), 4.5-5.5 (X), 9.0-11.4 (⊡)

FIGURE 13a. POWER SPECTRA - HUME1, CROSSTRACK



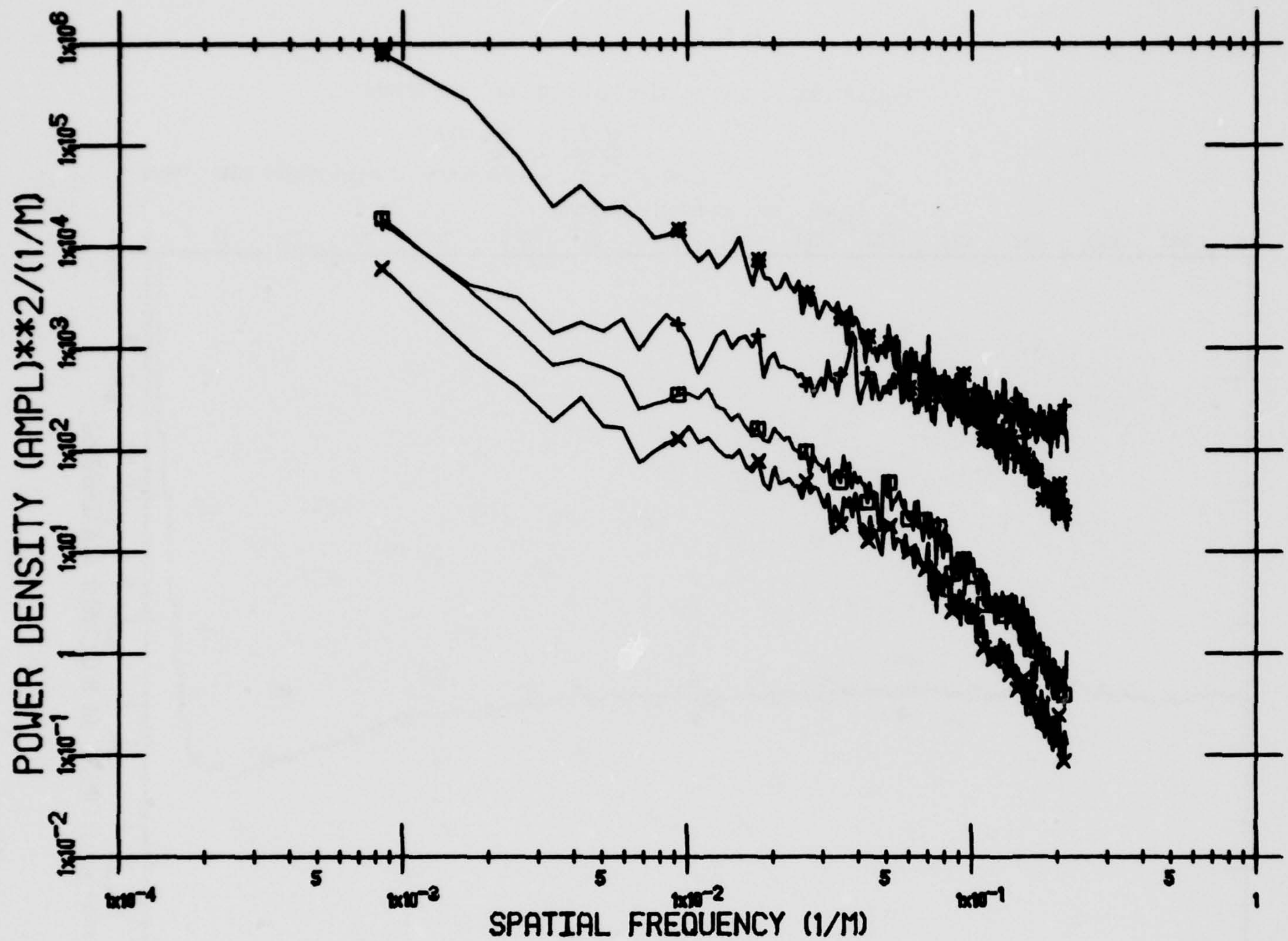
Area: HUM1 INTRACK Wavelength = 2.0-2.6 (*), 4.5-5.5 (X), 9.0-11.4 (⊡)

FIGURE 13b. POWER SPECTRA - HUME1, INTRACK



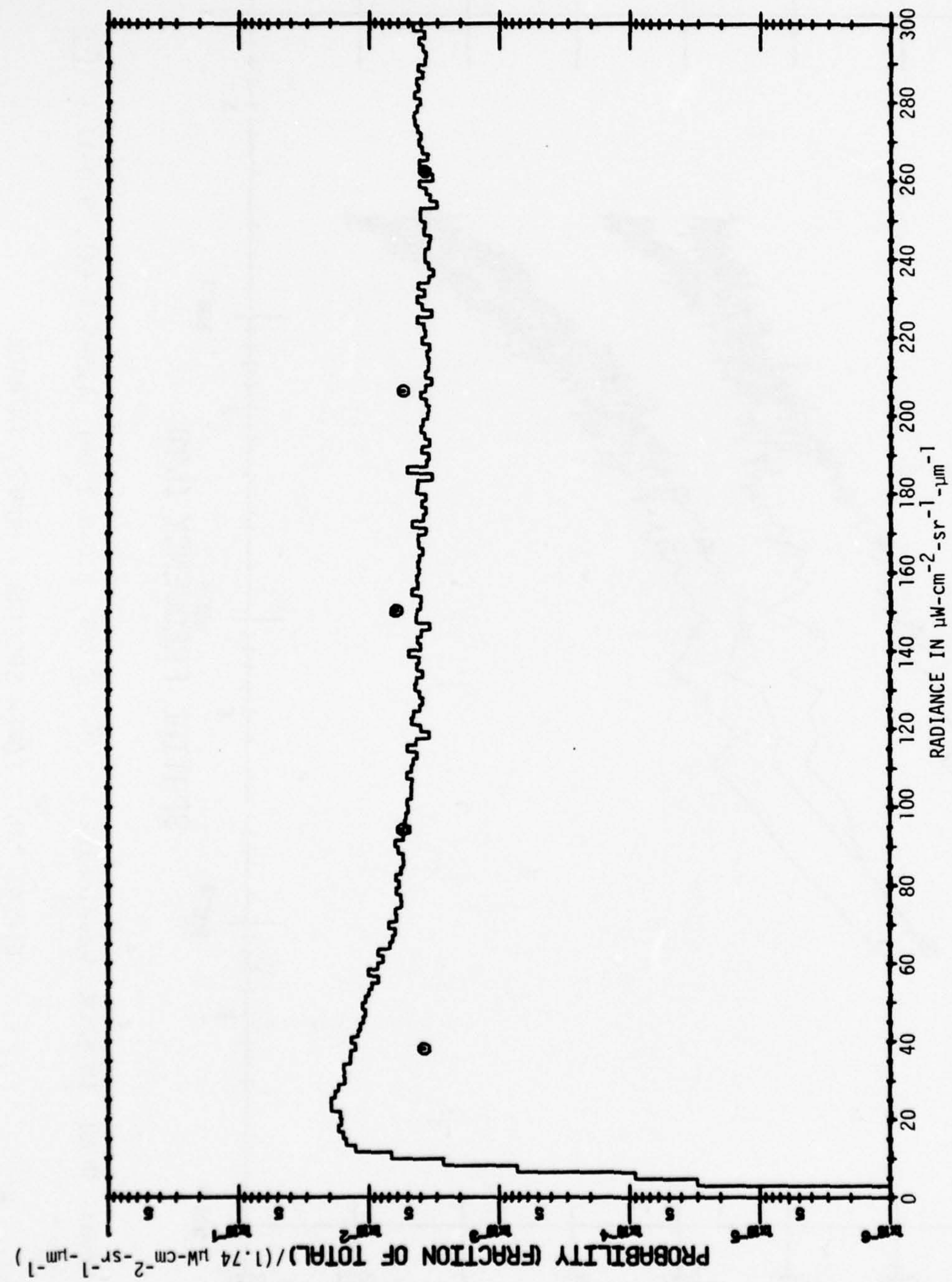
Area: HUM2 CROSSTRACK Wavelength = 2.0-2.6 (*), 3.0-4.2 (+), 4.5-5.5 (X), 9.0-11.4 (⊡)

FIGURE 14a. POWER SPECTRA - HUME2, CROSSTRACK



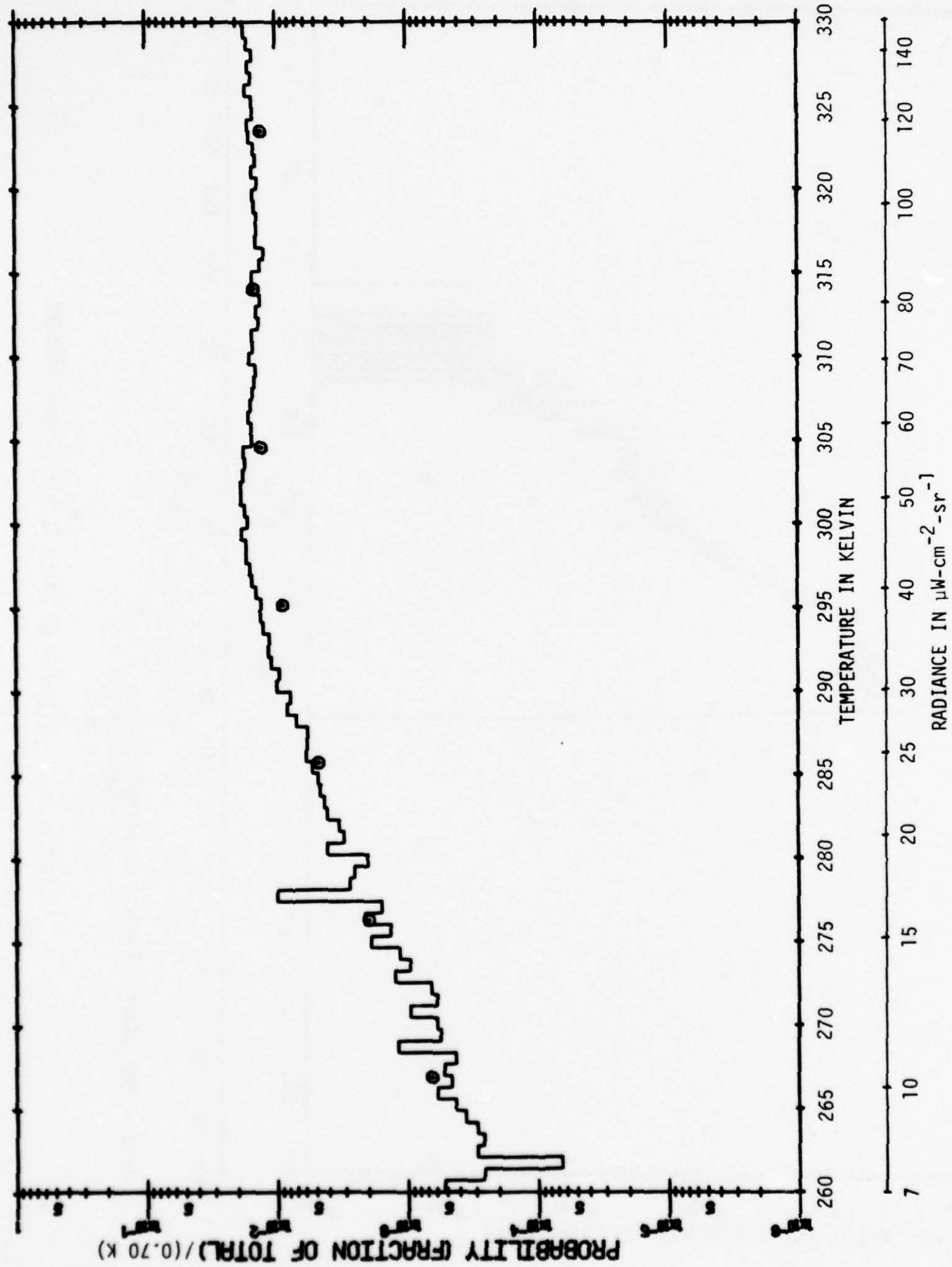
Area: HUM2 INTRACK Wavelength = 2.0-2.6 (*), 3.0-4.2 (+), 4.5-5.5 (X), 9.0-11.4 (⊡)

FIGURE 14b. POWER SPECTRA - HUME2, INTRACK



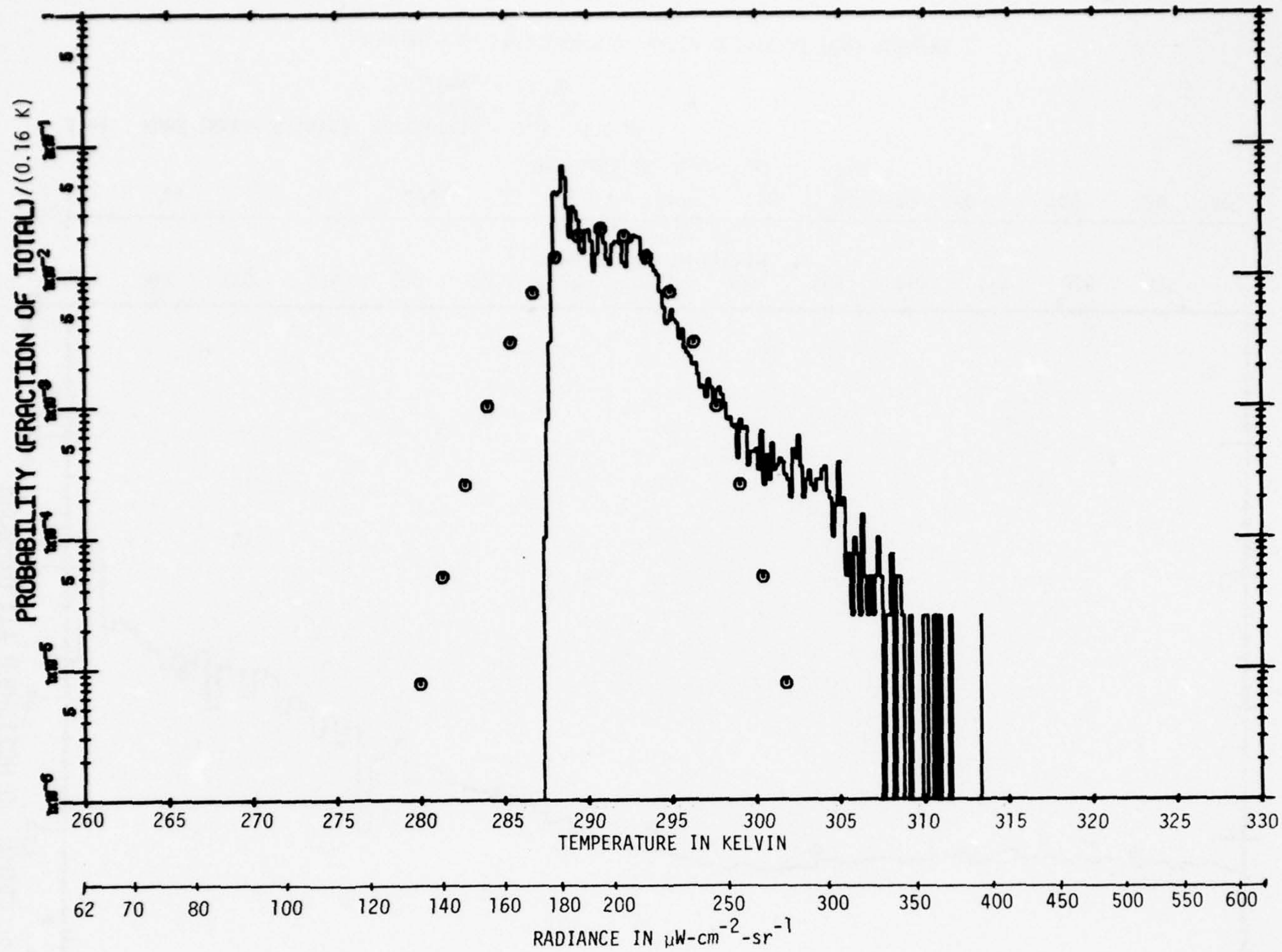
Area: HUM2 (Water Glints) Wavelength = 2.0 - 2.6 µm
Mean = 150.25
Std. Dev. = 112.05

FIGURE 15a. HISTOGRAM OF WATER GLINTS AT PORT HUENEME



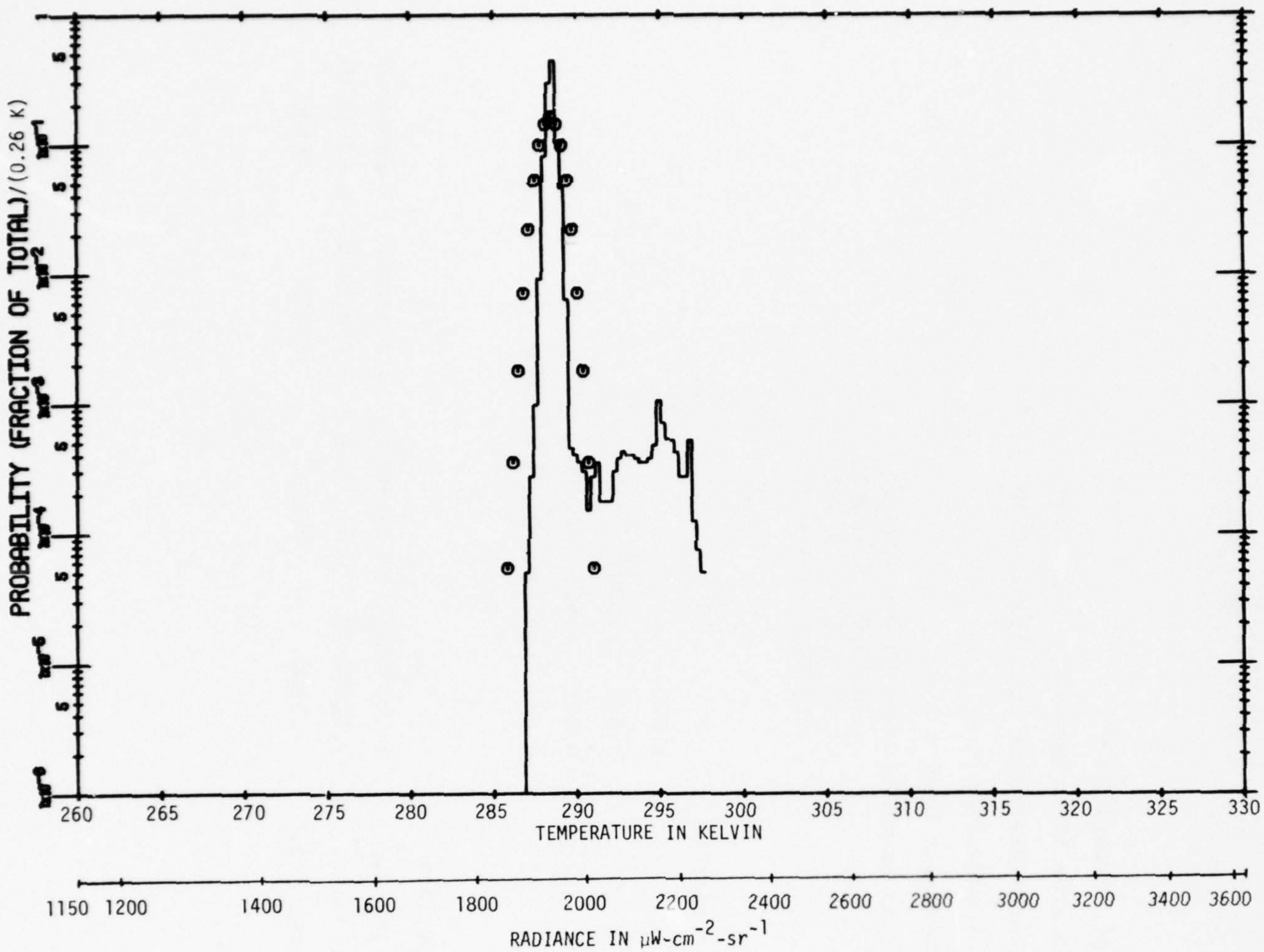
Area: HUM2 (Water Glints) Wavelength = 3.0 - 4.2 μm
Mean = 314.05
Std. Dev. = 18.86

FIGURE 15b. HISTOGRAM OF WATER GLINTS AT PORT HUENEME



Area: HUM2 (Water Glints) Wavelength = 4.5 - 5.5 μm
Mean = 290.83
Std. Dev. = 2.72

FIGURE 15c. HISTOGRAM OF WATER GLINTS AT PORT HUENEME



Area: HUM2 (Water Glints) Wavelength = 9.0 - 11.4 μm
Mean = 288.46
Std. Dev. = 0.65

FIGURE 15d. HISTOGRAM OF WATER GLINTS AT PORT HUENEME

TABLE 9

Glints on Open Water - HUME2

Number of Subregions = 1

Pixel Subarea Divisions at: 301 500

Line Subarea Divisions at: 1351 1550

Line Increment Used = 1

Pixel Increment Used = 1

Correlation Channels: 6 (2.0 - 2.6 μm)
10 (3.0 - 4.2 μm)
11 (4.5 - 5.5 μm)
12 (9.0 - 11.4 μm)

Correlation	6	10	11	12
6	1.000			
10	0.846	1.000		
11	0.892	0.683	1.000	
12	-0.094	-0.113	0.049	1.000

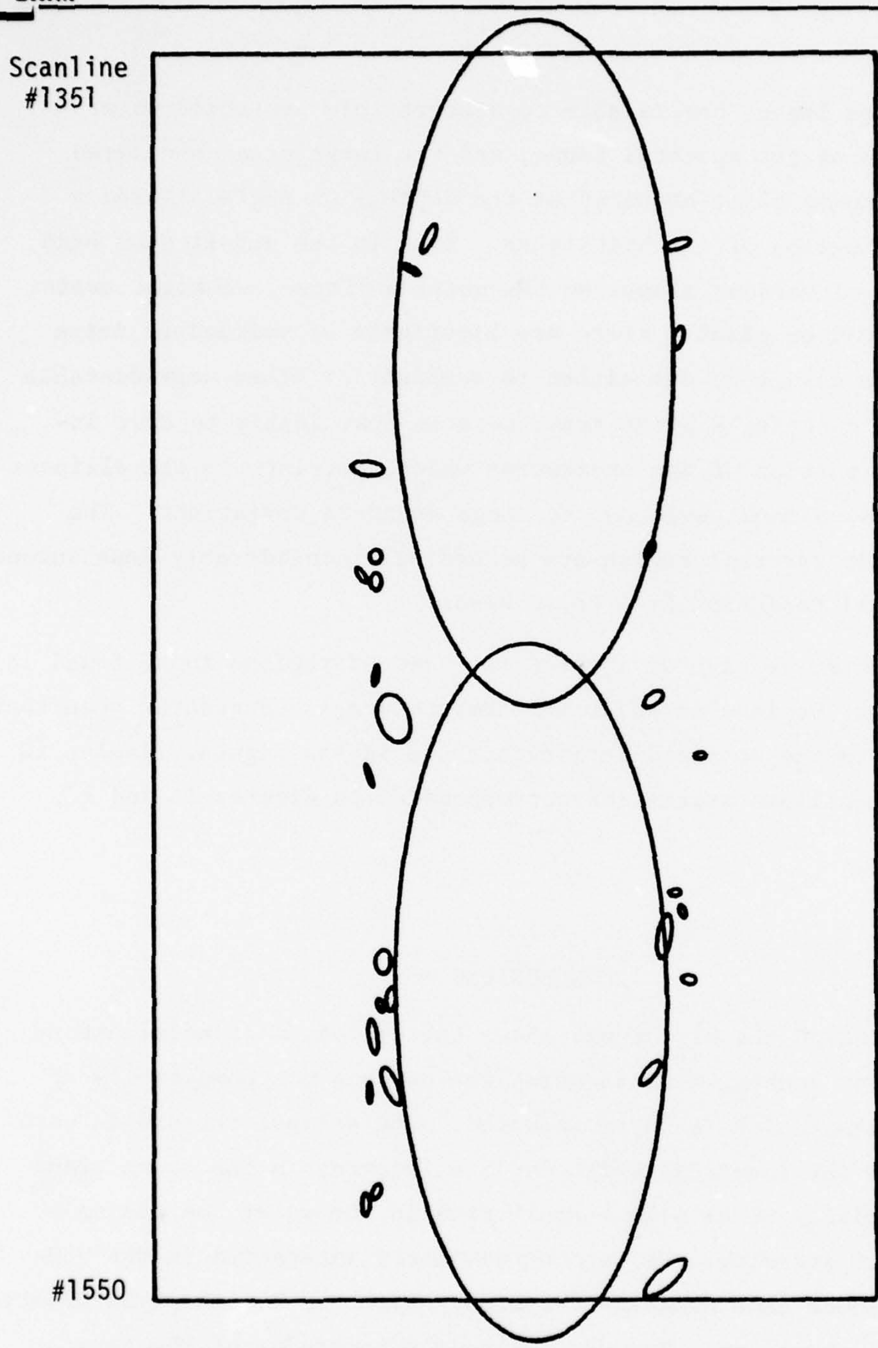
Channels	6	10	11	12
Mean	1.5025E+02	3.1405E+02	2.9083E+02	2.8846E+02
St. Dev.	1.1205E+02	1.8863E+01	2.7197E+00	6.4991E-01
Total Pts.	39800.	39800.	39800.	39800.

figures, Figures 16a-n, one is able to discern this protected water area in certain of the spectral bands, and the large area associated with the continuous glint obtained as the depression angle allowed a convenient collection of sun highlights. Even in the 9.0-11.4 μm band, where, because of various slopes on the water surfaces, we might expect little in the way of glints, there are highlights of sufficient intensity to produce ellipses, due either to sunlight or other unpredictable phenomena. In choosing a glint area, we seem unavoidably to have included a small portion of the breakwater which persists in the ellipses of the 9.0-11.4 μm band, even out to large standard deviations. The "glints" in this spectral region are accordingly considerably less intense than the thermal radiation from solid areas.

In Figure 17, we have designated the coldest regions to be found in the water, i.e., regions in which the temperature is no greater than that corresponding to the standard deviation shown in the figure. Tables 10 and 11 are the ellipse statistics corresponding to Figures 16 and 17, respectively.

7
CONCLUSIONS

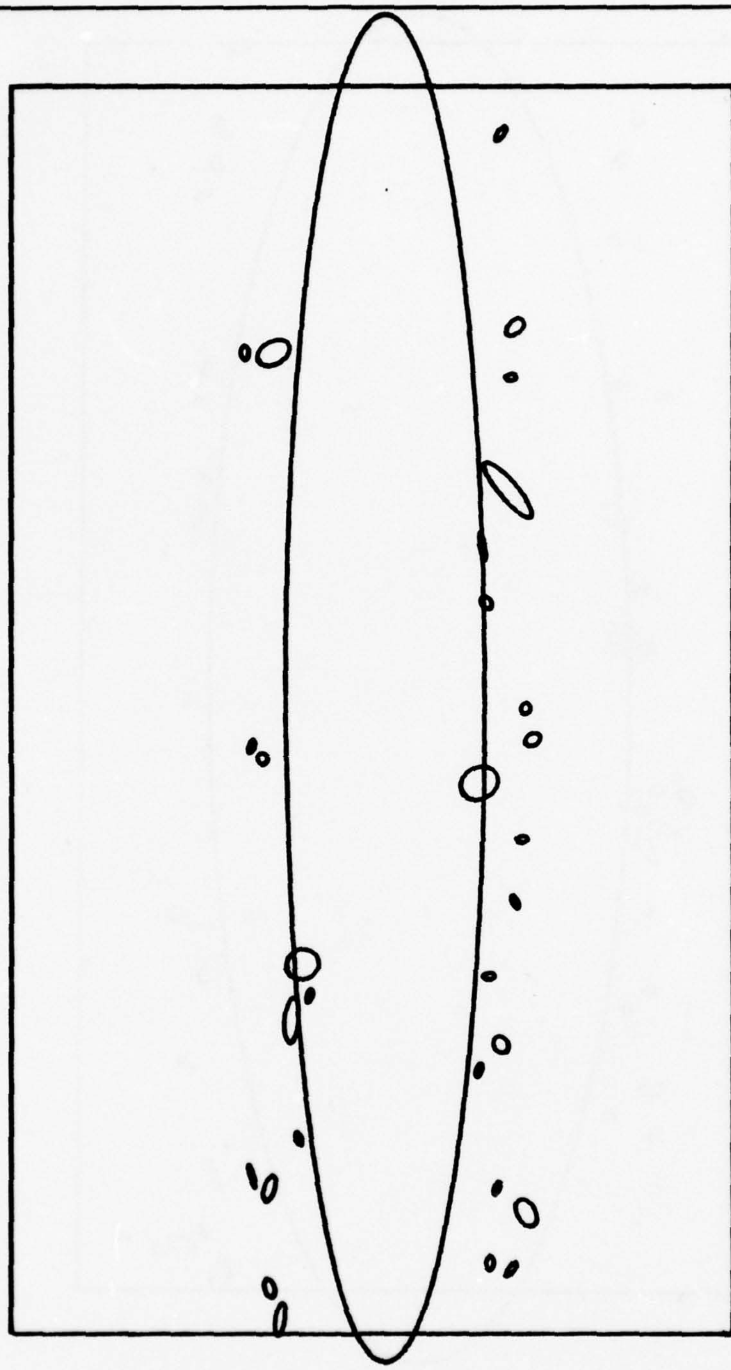
Examination of the histograms shows the evident multimodal nature of the different scenes, demonstrating the obvious non-homogeneity of even small areas, which is to be expected. The ellipse thresholds were chosen to show the levels at which various features in the scene stand out. We especially chose also a small area in the water containing a large sun glint activity. We were particularly interested in the 9.0-11.4 μm band where some singular features, which could perhaps be identified as glint, showed up. However, without a knowledge of the water conditions, it is not possible to say just what the causes of these singularities were. For comparison we looked also at the colder features in the glint area and found some similarities with the hot features.



Area: HUM2 (Water Glints)
Radiance Threshold
= Ave. + 0.50 σ
Wavelength = 2.0 - 2.6 μm

FIGURE 16a. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline
#1351



#1550

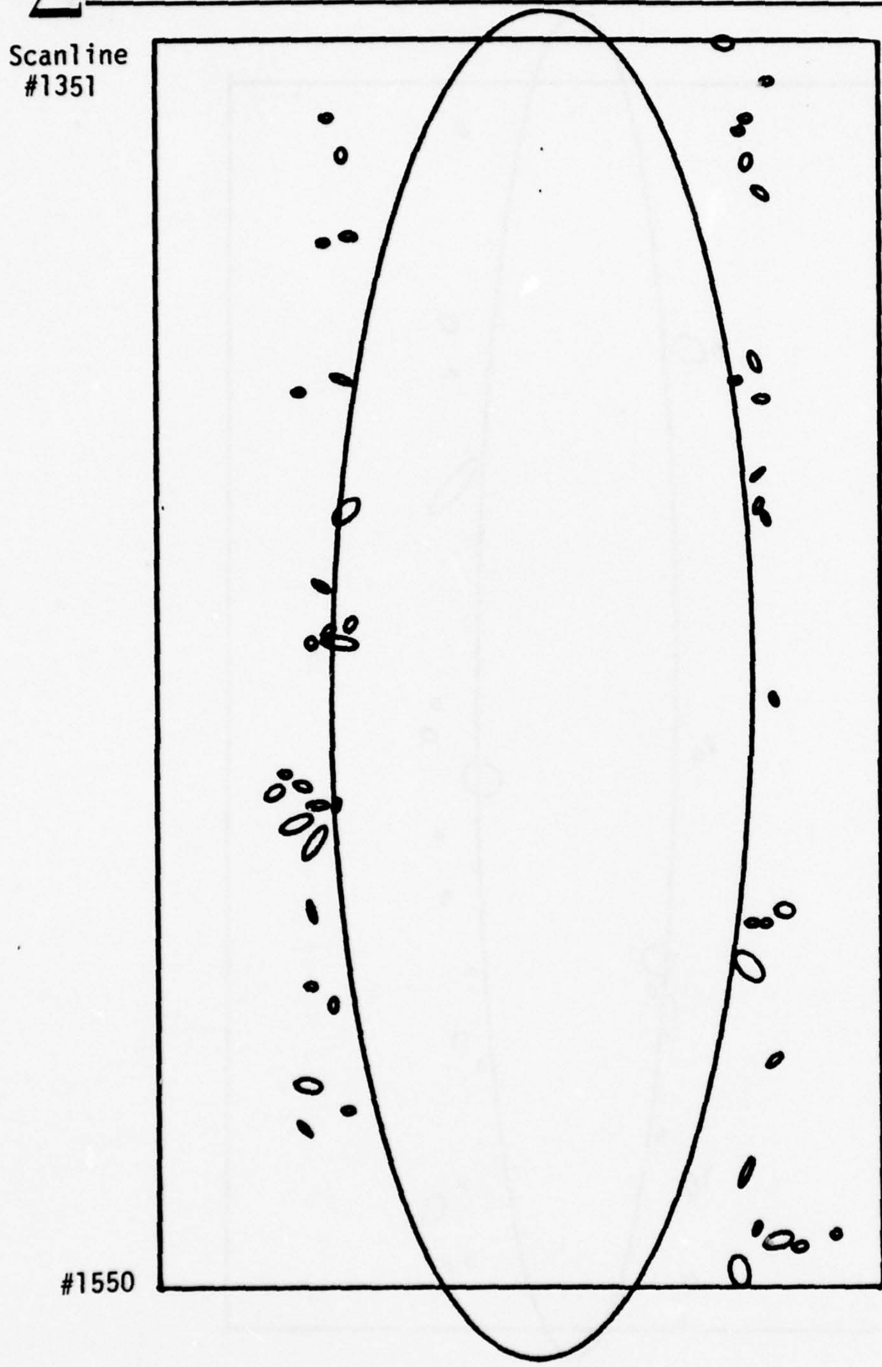
Area: HUM2 (Water Glints)

Radiance Threshold

= Ave. + 1.00 σ

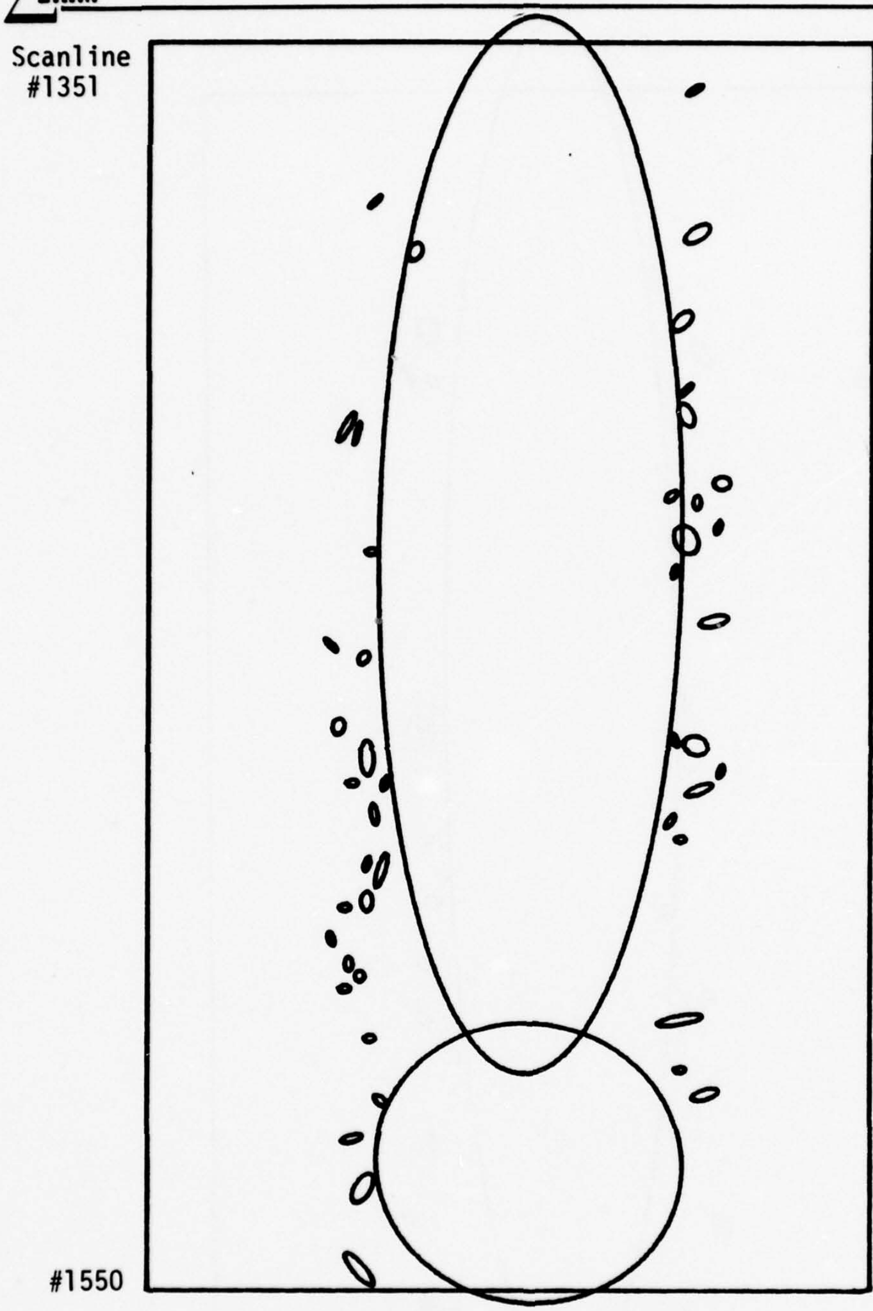
Wavelength = 2.0 - 2.6 μm

FIGURE 16b. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



Area: HUM2 (Water Glints)
Temperature Threshold
= Ave. + 0.00 σ
Wavelength = 3.0 - 4.2 μm

FIGURE 16c. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



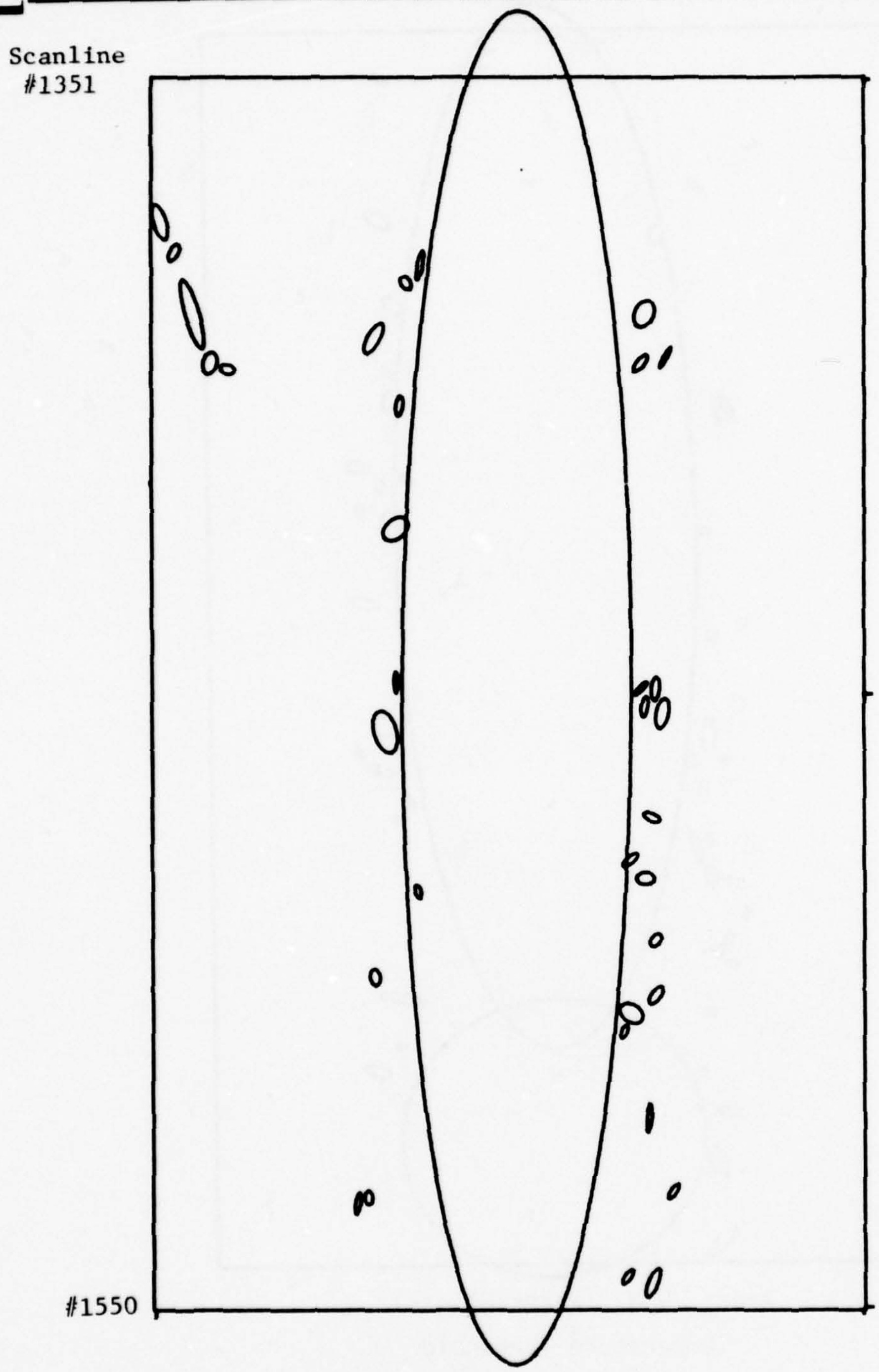
Area: HUM2 (Water Glints)

Temperature Threshold

= Ave. + 0.50 σ

Wavelength = 3.0 - 4.2 μm

FIGURE 16d. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



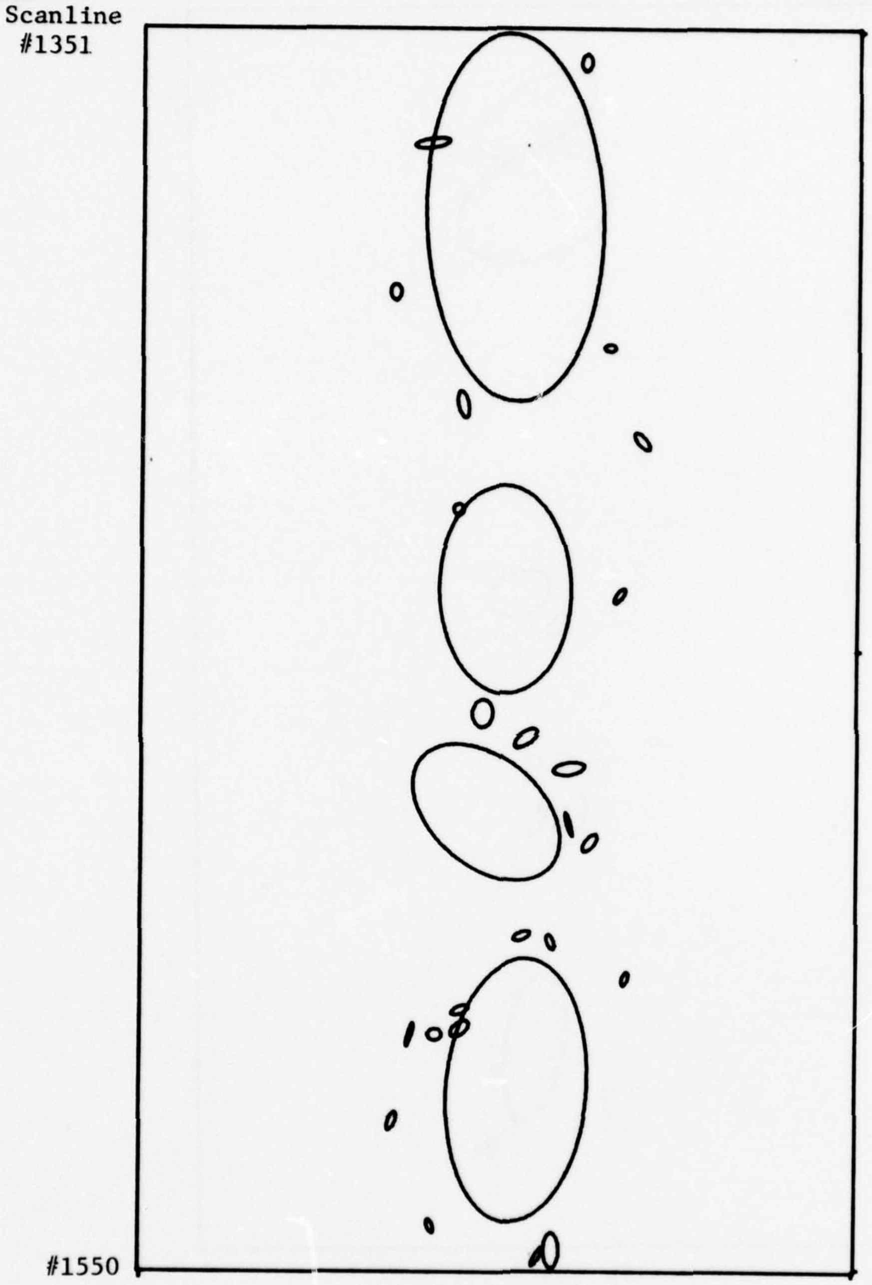
Area: HUM2 (Water Glints)

Temperature Threshold

= Ave. + 0.50 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 16e. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



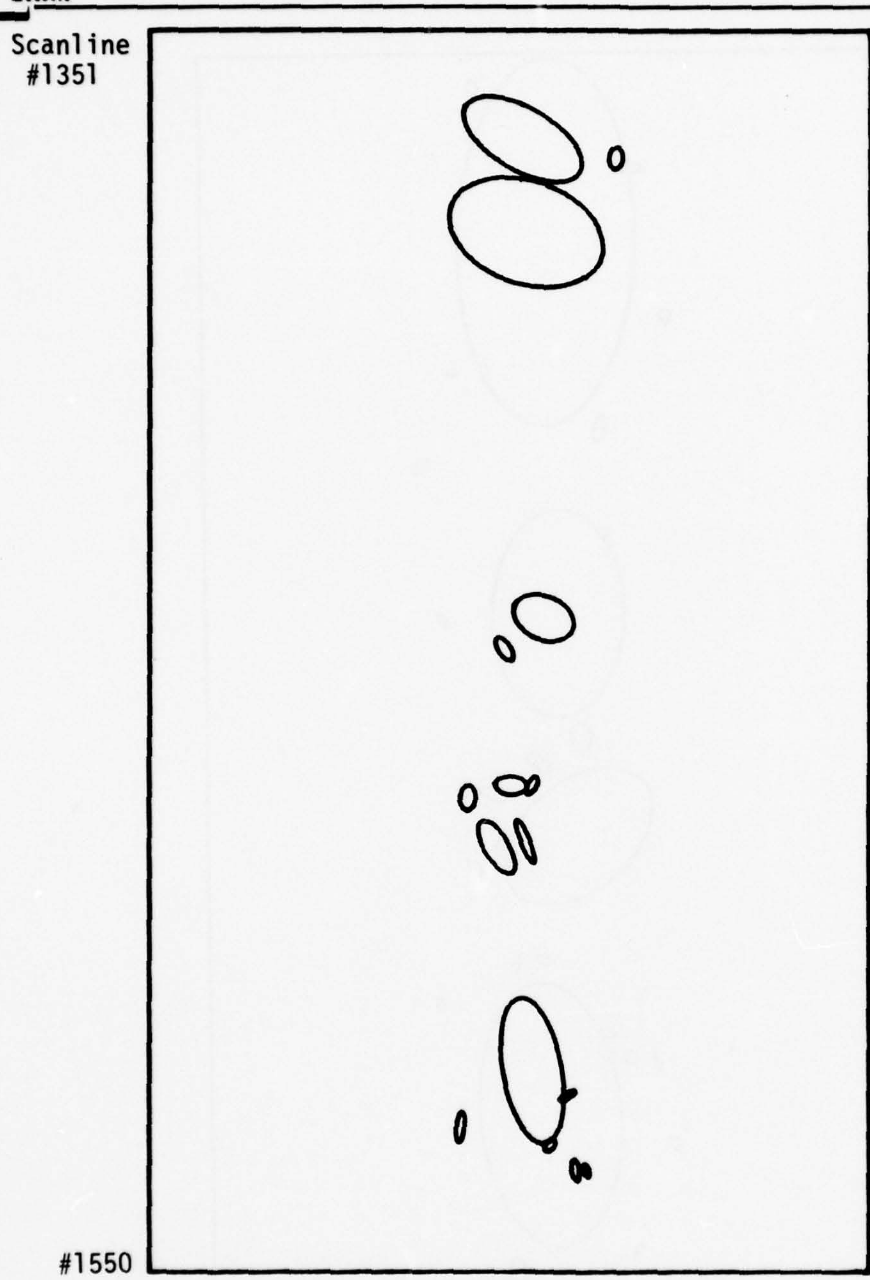
Area: HUM2 (Water Glints)

Temperature Threshold

= Ave. + 1.00 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 16f. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



Area: HUM2 (Water Glints)

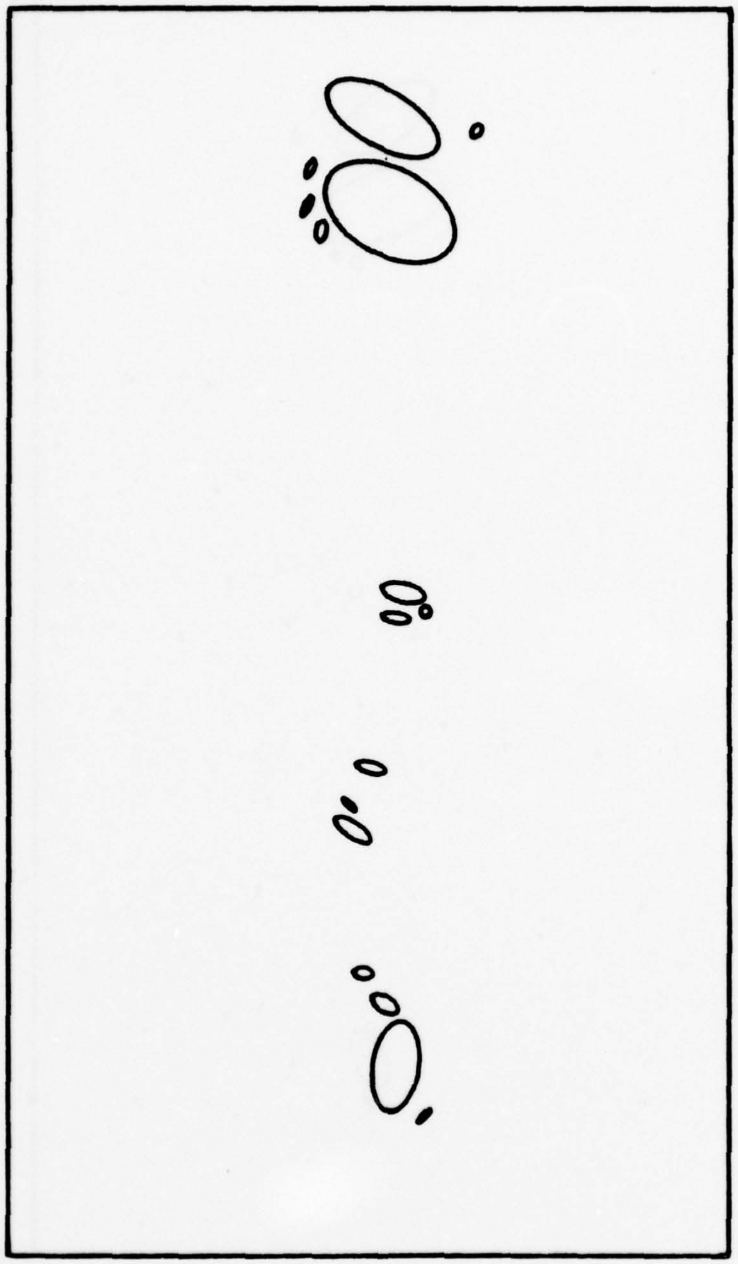
Temperature Threshold

= Ave. + 2.00 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 16g. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline
#1351



#1550

Area: HUM2 (Water Glints)

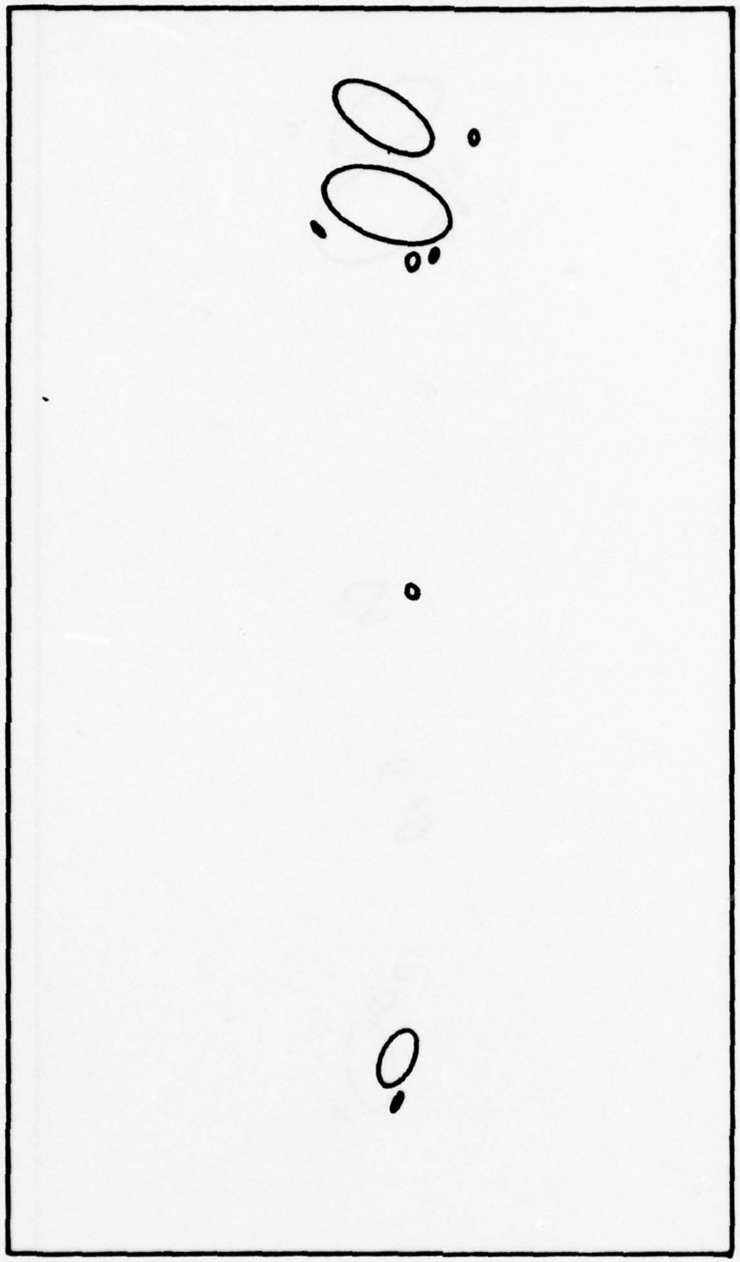
Temperature Threshold

= Ave. + 2.50 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 16h. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline
#1351



#1550

Area: HUM2 (Water Glints)

Temperature Threshold

= Ave. + 3.00 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 16i. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

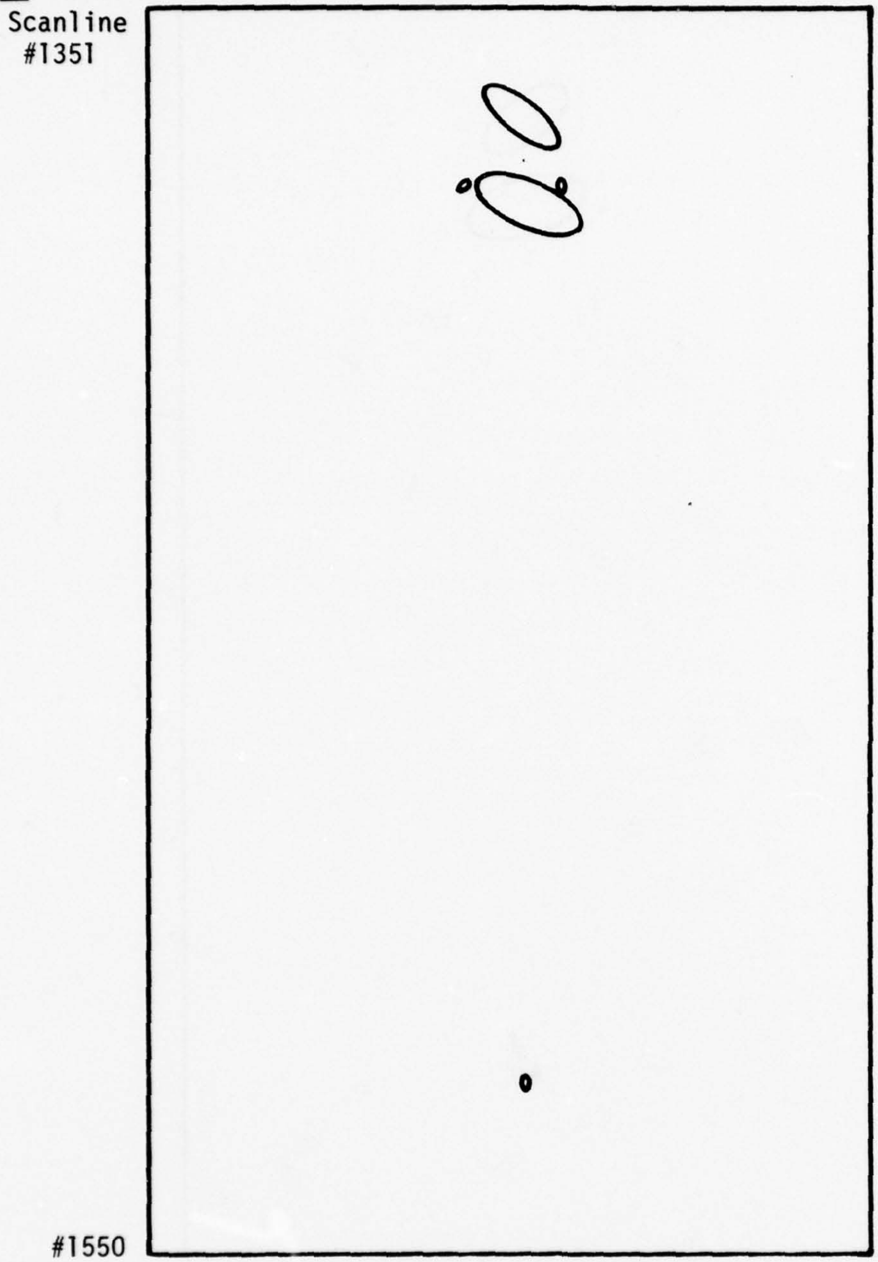
Area: HUM2 (Water Glints)

Temperature Threshold

= Ave. + 3.50 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 16j. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



Area: HUM2 (Water Glints)

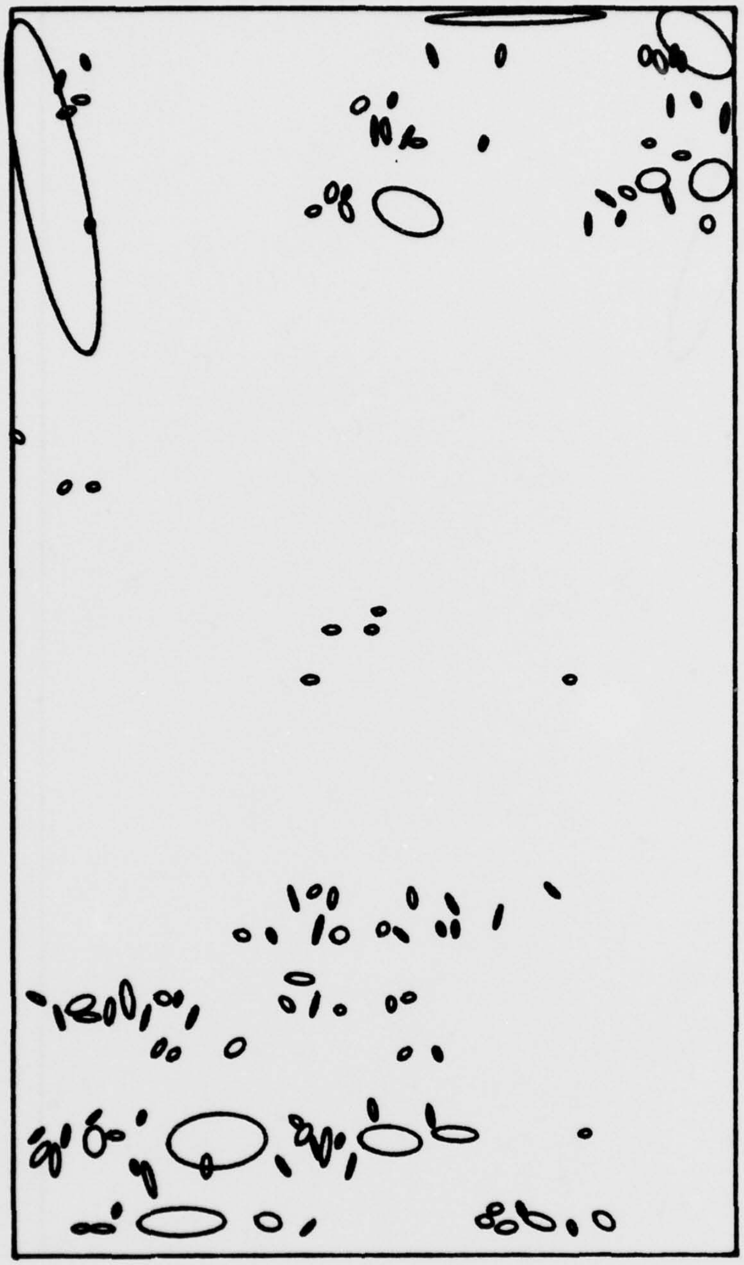
Temperature Threshold

= Ave. + 4.00 σ

Wavelength = 4.5 - 5.5 μm

FIGURE 16k. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline
#1351



#1550

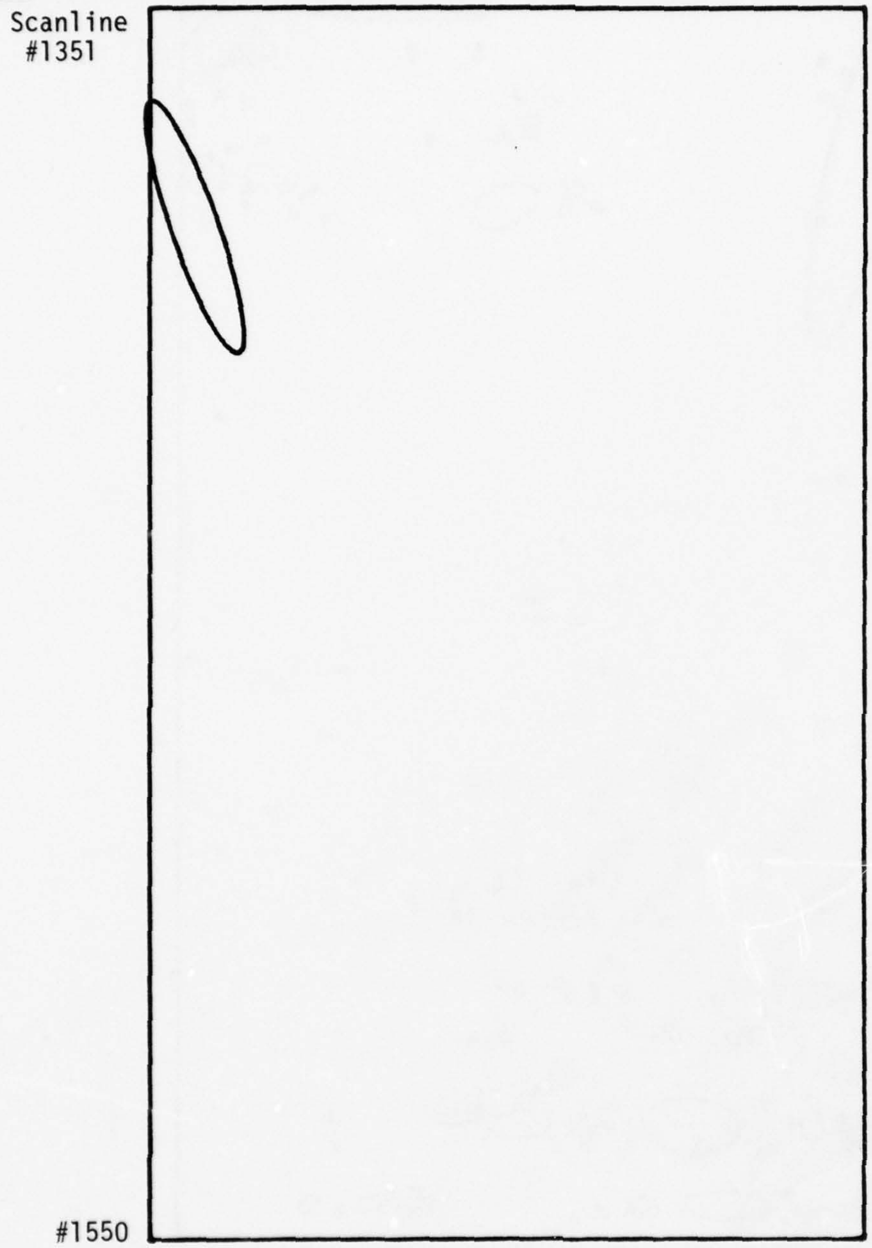
Area: HUM2 (Water Glints)

Temperature Threshold

= Ave. + 1.00 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 16ℓ. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



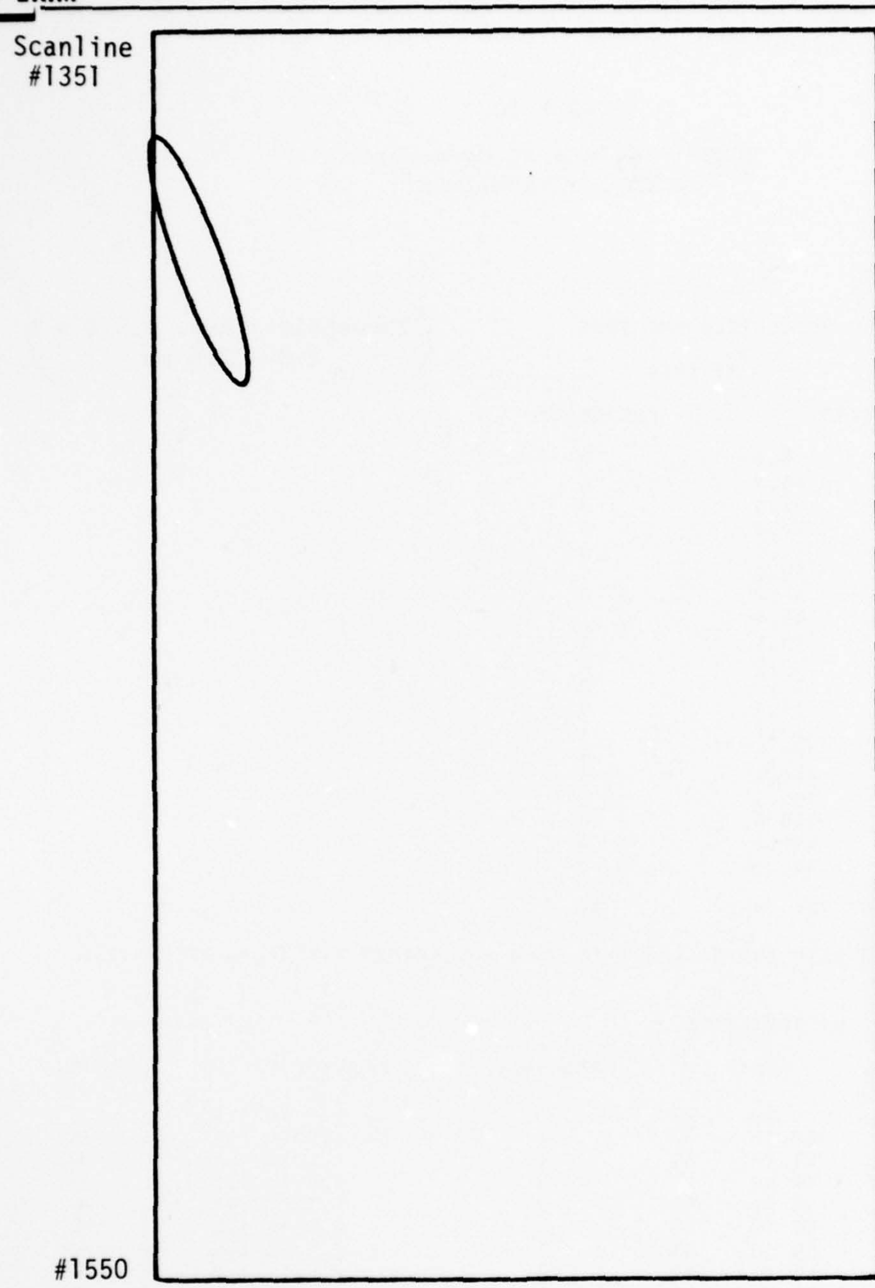
Area: HUM2 (Water Glints)

Temperature Threshold

= Ave. + 2.00 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 16m. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



Area: HUM2 (Water Glints)

Temperature Threshold

= Ave. + 3.00 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 16n. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

TABLE 10

HUME2 - Glints on Open Water
AREA DISTRIBUTIONS

(Threshold = Ave. + 0.5 σ
2.0 - 2.6 μm)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	6
10.0	TO	15.0	3
15.0	TO	20.0	5
20.0	TO	25.0	3
25.0	TO	30.0	1
30.0	TO	35.0	3
35.0	TO	40.0	1
40.0	TO	45.0	1
45.0	TO	50.0	1
50.0	TO	75.0	2
75.0	TO	100.0	0
100.0	TO	150.0	1
150.0	TO	200.0	1
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	2

TOTAL NUMBER OF HOT SPOT = 30

57 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	2
14	TO	16	45	TO	52	2
16	TO	17	52	TO	55	1
17	TO	20	55	TO	65	7
20	TO	22	65	TO	72	3
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	1
28	TO	30	91	TO	98	1
30	TO	32	98	TO	104	1
32	TO	39	104	TO	127	3
39	TO	45	127	TO	147	2
45	TO	55	147	TO	180	1
55	TO	71	180	TO	232	3
71	TO	100	232	TO	328	1
OVER		100	OVER		328	2

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	3
1.2	TO	1.3	1
1.3	TO	1.4	4
1.4	TO	1.5	2
1.5	TO	1.6	5
1.6	TO	1.7	3
1.7	TO	1.8	2
1.8	TO	1.9	3
1.9	TO	2.0	2
2.0	TO	2.4	2
2.4	TO	2.6	0
2.6	TO	2.8	1
2.8	TO	3.0	0
3.0	TO	3.5	0
3.5	TO	4.0	2
4.0	TO	4.5	0
OVER		4.5	0

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT
BY AREA

(Threshold = Ave. + 1.0 σ
2.0 - 2.6 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	10
10.0	TO	15.0	6
15.0	TO	20.0	2
20.0	TO	25.0	2
25.0	TO	30.0	1
30.0	TO	35.0	3
35.0	TO	40.0	0
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	2
75.0	TO	100.0	1
100.0	TO	150.0	3
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	1

TOTAL NUMBER OF HOT SPOT = 31

51 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	3
14	TO	16	45	TO	52	8
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	7
20	TO	22	65	TO	72	0
22	TO	24	72	TO	78	1
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	2
28	TO	30	91	TO	98	2
30	TO	32	98	TO	104	1
32	TO	39	104	TO	127	0
39	TO	45	127	TO	147	1
45	TO	55	147	TO	180	0
55	TO	71	180	TO	232	2
71	TO	100	232	TO	328	2
OVER		100	OVER		328	2

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	5
1.2	TO	1.3	2
1.3	TO	1.4	12
1.4	TO	1.5	1
1.5	TO	1.6	0
1.6	TO	1.7	1
1.7	TO	1.8	5
1.8	TO	1.9	0
1.9	TO	2.0	1
2.0	TO	2.4	2
2.4	TO	2.6	0
2.6	TO	2.8	1
2.8	TO	3.0	0
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	1

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 0.0 σ
3.0 - 4.2 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	19
10.0	TO	15.0	8
15.0	TO	20.0	10
20.0	TO	25.0	2
25.0	TO	30.0	2
30.0	TO	35.0	0
35.0	TO	40.0	1
40.0	TO	45.0	1
45.0	TO	50.0	3
50.0	TO	75.0	2
75.0	TO	100.0	1
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	1

TOTAL NUMBER OF HOT SPOT = 50

122 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	12
14	TO	16	45	TO	52	7
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	11
20	TO	22	65	TO	72	3
22	TO	24	72	TO	78	2
24	TO	26	78	TO	85	1
26	TO	28	85	TO	91	0
28	TO	30	91	TO	98	3
30	TO	32	98	TO	104	1
32	TO	39	104	TO	127	4
39	TO	45	127	TO	147	2
45	TO	55	147	TO	180	0
55	TO	71	180	TO	232	2
71	TO	100	232	TO	328	1
OVER		100	OVER		328	1

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	14
1.2	TO	1.3	4
1.3	TO	1.4	6
1.4	TO	1.5	5
1.5	TO	1.6	6
1.6	TO	1.7	5
1.7	TO	1.8	1
1.8	TO	1.9	0
1.9	TO	2.0	2
2.0	TO	2.4	4
2.4	TO	2.6	1
2.6	TO	2.8	0
2.8	TO	3.0	1
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	1

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 0.5 σ
3.0 - 4.2 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	18
10.0	TO	15.0	7
15.0	TO	20.0	3
20.0	TO	25.0	3
25.0	TO	30.0	3
30.0	TO	35.0	3
35.0	TO	40.0	2
40.0	TO	45.0	1
45.0	TO	50.0	3
50.0	TO	75.0	3
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	2

TOTAL NUMBER OF HOT SPOT = 48

78 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	7
14	TO	16	45	TO	52	9
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	12
20	TO	22	65	TO	72	0
22	TO	24	72	TO	78	1
24	TO	26	78	TO	85	2
26	TO	28	85	TO	91	1
28	TO	30	91	TO	98	2
30	TO	32	98	TO	104	2
32	TO	39	104	TO	127	2
39	TO	45	127	TO	147	2
45	TO	55	147	TO	180	4
55	TO	71	180	TO	232	1
71	TO	100	232	TO	328	1
OVER		100	OVER		328	2

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	10
1.2	TO	1.3	1
1.3	TO	1.4	14
1.4	TO	1.5	6
1.5	TO	1.6	3
1.6	TO	1.7	1
1.7	TO	1.8	2
1.8	TO	1.9	5
1.9	TO	2.0	1
2.0	TO	2.4	4
2.4	TO	2.6	1
2.6	TO	2.8	0
2.8	TO	3.0	0
3.0	TO	3.5	0
3.5	TO	4.0	1
4.0	TO	4.5	0
	OVER	4.5	1

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT BY AREA

(Threshold = Ave. + 0.5 σ 4.5 - 5.5 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	5
10.0	TO	15.0	4
15.0	TO	20.0	12
20.0	TO	25.0	3
25.0	TO	30.0	0
30.0	TO	35.0	2
35.0	TO	40.0	0
40.0	TO	45.0	1
45.0	TO	50.0	2
50.0	TO	75.0	3
75.0	TO	100.0	0
100.0	TO	150.0	2
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	1

TOTAL NUMBER OF HOT SPOT = 35

58 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	0
14 TO 16	45 TO 52	3
16 TO 17	52 TO 55	1
17 TO 20	55 TO 65	11
20 TO 22	65 TO 72	3
22 TO 24	72 TO 78	2
24 TO 26	78 TO 85	2
26 TO 28	85 TO 91	1
28 TO 30	91 TO 98	1
30 TO 32	98 TO 104	1
32 TO 39	104 TO 127	1
39 TO 45	127 TO 147	2
45 TO 55	147 TO 180	3
55 TO 71	180 TO 232	0
71 TO 100	232 TO 328	3
OVER 100	OVER 328	1

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	1
1.2 TO 1.3	3
1.3 TO 1.4	6
1.4 TO 1.5	7
1.5 TO 1.6	3
1.6 TO 1.7	5
1.7 TO 1.8	1
1.8 TO 1.9	1
1.9 TO 2.0	3
2.0 TO 2.4	2
2.4 TO 2.6	1
2.6 TO 2.8	1
2.8 TO 3.0	0
3.0 TO 3.5	0
3.5 TO 4.0	0
4.0 TO 4.5	0
OVER 4.5	1

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 1.0 σ
4.5 - 5.5 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	5
10.0	TO	15.0	4
15.0	TO	20.0	6
20.0	TO	25.0	2
25.0	TO	30.0	1
30.0	TO	35.0	2
35.0	TO	40.0	1
40.0	TO	45.0	1
45.0	TO	50.0	0
50.0	TO	75.0	2
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	4

TOTAL NUMBER OF HOT SPOT = 28

63 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	1
14	TO	16	45	TO	52	2
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	7
20	TO	22	65	TO	72	4
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	2
28	TO	30	91	TO	98	2
30	TO	32	98	TO	104	1
32	TO	39	104	TO	127	0
39	TO	45	127	TO	147	2
45	TO	55	147	TO	180	2
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	1
OVER		100	OVER		328	4

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	1
1.2	TO	1.3	0
1.3	TO	1.4	6
1.4	TO	1.5	4
1.5	TO	1.6	1
1.6	TO	1.7	0
1.7	TO	1.8	7
1.8	TO	1.9	1
1.9	TO	2.0	1
2.0	TO	2.4	2
2.4	TO	2.6	0
2.6	TO	2.8	0
2.8	TO	3.0	0
3.0	TO	3.5	1
3.5	TO	4.0	1
4.0	TO	4.5	1
	OVER	4.5	2

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 2.0 σ
4.5 - 5.5 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	1
10.0	TO	15.0	1
15.0	TO	20.0	3
20.0	TO	25.0	0
25.0	TO	30.0	1
30.0	TO	35.0	1
35.0	TO	40.0	1
40.0	TO	45.0	1
45.0	TO	50.0	1
50.0	TO	75.0	1
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	1
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	1
400.0	TO	500.0	0
	OVER	500.0	3

TOTAL NUMBER OF HOT SPOT = 16

16 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	0
14 TO 16	45 TO 52	1
16 TO 17	52 TO 55	0
17 TO 20	55 TO 65	2
20 TO 22	65 TO 72	1
22 TO 24	72 TO 78	0
24 TO 26	78 TO 85	0
26 TO 28	85 TO 91	1
28 TO 30	91 TO 98	1
30 TO 32	98 TO 104	2
32 TO 39	104 TO 127	0
39 TO 45	127 TO 147	1
45 TO 55	147 TO 180	1
55 TO 71	180 TO 232	1
71 TO 100	232 TO 328	0
OVER 100	OVER 328	5

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	0
1.2 TO 1.3	1
1.3 TO 1.4	1
1.4 TO 1.5	3
1.5 TO 1.6	0
1.6 TO 1.7	2
1.7 TO 1.8	4
1.8 TO 1.9	0
1.9 TO 2.0	0
2.0 TO 2.4	3
2.4 TO 2.6	0
2.6 TO 2.8	0
2.8 TO 3.0	0
3.0 TO 3.5	1
3.5 TO 4.0	1
4.0 TO 4.5	0
OVER 4.5	0

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 2.5 σ
4.5 - 5.5 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	2
10.0	TO	15.0	1
15.0	TO	20.0	3
20.0	TO	25.0	2
25.0	TO	30.0	0
30.0	TO	35.0	1
35.0	TO	40.0	1
40.0	TO	45.0	0
45.0	TO	50.0	1
50.0	TO	75.0	1
75.0	TO	100.0	1
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	1
	OVER	500.0	2

TOTAL NUMBER OF HOT SPOT = 16

15 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	0
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	4
20	TO	22	65	TO	72	2
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	1
28	TO	30	91	TO	98	1
30	TO	32	98	TO	104	1
32	TO	39	104	TO	127	1
39	TO	45	127	TO	147	0
45	TO	55	147	TO	180	2
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	1
OVER		100	OVER		328	3

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	0
1.2	TO	1.3	1
1.3	TO	1.4	1
1.4	TO	1.5	1
1.5	TO	1.6	6
1.6	TO	1.7	0
1.7	TO	1.8	0
1.8	TO	1.9	4
1.9	TO	2.0	0
2.0	TO	2.4	0
2.4	TO	2.6	1
2.6	TO	2.8	0
2.8	TO	3.0	0
3.0	TO	3.5	2
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	0

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 3.0 σ
4.5 - 5.5 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	2
10.0	TO	15.0	2
15.0	TO	20.0	1
20.0	TO	25.0	1
25.0	TO	30.0	0
30.0	TO	35.0	0
35.0	TO	40.0	0
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	0
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	1
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	2

TOTAL NUMBER OF HOT SPOT = 9

17 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	0
14	TO	16	45	TO	52	2
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	2
20	TO	22	65	TO	72	1
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	1
26	TO	28	85	TO	91	0
28	TO	30	91	TO	98	0
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	0
39	TO	45	127	TO	147	0
45	TO	55	147	TO	180	0
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	0
OVER		100	OVER		328	3

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	1
1.2	TO	1.3	1
1.3	TO	1.4	1
1.4	TO	1.5	1
1.5	TO	1.6	1
1.6	TO	1.7	0
1.7	TO	1.8	1
1.8	TO	1.9	0
1.9	TO	2.0	1
2.0	TO	2.4	1
2.4	TO	2.6	0
2.6	TO	2.8	0
2.8	TO	3.0	1
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	0

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 3.5 σ
4.5 - 5.5 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	1
10.0	TO	15.0	0
15.0	TO	20.0	0
20.0	TO	25.0	1
25.0	TO	30.0	0
30.0	TO	35.0	0
35.0	TO	40.0	1
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	0
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	1
	OVER	500.0	1

TOTAL NUMBER OF HOT SPOT = 5

8 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	0
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	0
20	TO	22	65	TO	72	1
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	0
28	TO	30	91	TO	98	0
30	TO	32	98	TO	104	1
32	TO	39	104	TO	127	1
39	TO	45	127	TO	147	0
45	TO	55	147	TO	180	0
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	0
OVER		100	OVER		328	2

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	0
1.2	TO	1.3	0
1.3	TO	1.4	0
1.4	TO	1.5	1
1.5	TO	1.6	0
1.6	TO	1.7	0
1.7	TO	1.8	0
1.8	TO	1.9	0
1.9	TO	2.0	1
2.0	TO	2.4	2
2.4	TO	2.6	0
2.6	TO	2.8	0
2.8	TO	3.0	1
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	0

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 4.0 σ
4.5 - 5.5 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	0
10.0	TO	15.0	3
15.0	TO	20.0	0
20.0	TO	25.0	0
25.0	TO	30.0	0
30.0	TO	35.0	0
35.0	TO	40.0	0
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	0
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	1
400.0	TO	500.0	0
	OVER	500.0	1

TOTAL NUMBER OF HOT SPOT = 5

11 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	0
14	TO	16	45	TO	52	2
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	1
20	TO	22	65	TO	72	0
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	0
28	TO	30	91	TO	98	0
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	0
39	TO	45	127	TO	147	0
45	TO	55	147	TO	180	0
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	0
OVER		100	OVER		328	2

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	2
1.2	TO	1.3	0
1.3	TO	1.4	1
1.4	TO	1.5	0
1.5	TO	1.6	0
1.6	TO	1.7	0
1.7	TO	1.8	0
1.8	TO	1.9	0
1.9	TO	2.0	0
2.0	TO	2.4	0
2.4	TO	2.6	1
2.6	TO	2.8	1
2.8	TO	3.0	0
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	0

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

(Threshold = Ave. + 1.0 σ
9.0 - 11.4 μm)

SQUARE METERS		FREQUENCY
0.0 TO	5.0	0
5.0 TO	10.0	39
10.0 TO	15.0	28
15.0 TO	20.0	20
20.0 TO	25.0	9
25.0 TO	30.0	5
30.0 TO	35.0	4
35.0 TO	40.0	0
40.0 TO	45.0	3
45.0 TO	50.0	1
50.0 TO	75.0	3
75.0 TO	100.0	0
100.0 TO	150.0	0
150.0 TO	200.0	2
200.0 TO	250.0	1
250.0 TO	300.0	1
300.0 TO	400.0	1
400.0 TO	500.0	1
OVER	500.0	2

TOTAL NUMBER OF HOT SPOT = 120

410 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	6
14 TO 16	45 TO 52	25
16 TO 17	52 TO 55	2
17 TO 20	55 TO 65	31
20 TO 22	65 TO 72	10
22 TO 24	72 TO 78	1
24 TO 26	78 TO 85	7
26 TO 28	85 TO 91	5
28 TO 30	91 TO 98	4
30 TO 32	98 TO 104	0
32 TO 39	104 TO 127	8
39 TO 45	127 TO 147	4
45 TO 55	147 TO 180	3
55 TO 71	180 TO 232	4
71 TO 100	232 TO 328	2
OVER 100	OVER 328	8

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	8
1.2 TO 1.3	7
1.3 TO 1.4	29
1.4 TO 1.5	2
1.5 TO 1.6	15
1.6 TO 1.7	4
1.7 TO 1.8	20
1.8 TO 1.9	1
1.9 TO 2.0	6
2.0 TO 2.4	13
2.4 TO 2.6	3
2.6 TO 2.8	2
2.8 TO 3.0	0
3.0 TO 3.5	4
3.5 TO 4.0	1
4.0 TO 4.5	1
OVER 4.5	4

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 2.0 σ
9.0 - 11.4 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	0
10.0	TO	15.0	0
15.0	TO	20.0	0
20.0	TO	25.0	0
25.0	TO	30.0	0
30.0	TO	35.0	0
35.0	TO	40.0	0
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	0
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	1

TOTAL NUMBER OF HOT SPOT = 1

1 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	0
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	0
20	TO	22	65	TO	72	0
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	0
28	TO	30	91	TO	98	0
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	0
39	TO	45	127	TO	147	0
45	TO	55	147	TO	180	0
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	0
OVER		100		OVER	328	1

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	0
1.2	TO	1.3	0
1.3	TO	1.4	0
1.4	TO	1.5	0
1.5	TO	1.6	0
1.6	TO	1.7	0
1.7	TO	1.8	0
1.8	TO	1.9	0
1.9	TO	2.0	0
2.0	TO	2.4	1
2.4	TO	2.6	0
2.6	TO	2.8	0
2.8	TO	3.0	0
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	0

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 3.0 σ
9.0 - 11.4 μm)

BY AREA

SQUARE METERS		FREQUENCY
0.0 TO	5.0	0
5.0 TO	10.0	0
10.0 TO	15.0	0
15.0 TO	20.0	0
20.0 TO	25.0	0
25.0 TO	30.0	0
30.0 TO	35.0	0
35.0 TO	40.0	0
40.0 TO	45.0	0
45.0 TO	50.0	0
50.0 TO	75.0	0
75.0 TO	100.0	0
100.0 TO	150.0	0
150.0 TO	200.0	0
200.0 TO	250.0	0
250.0 TO	300.0	0
300.0 TO	400.0	0
400.0 TO	500.0	0
OVER	500.0	1

TOTAL NUMBER OF HOT SPOT = 1

BY PERIMETER

METERS		FEET		FREQUENCY
0 TO	7	0 TO	22	0
7 TO	10	22 TO	32	0
10 TO	12	32 TO	39	0
12 TO	14	39 TO	45	0
14 TO	16	45 TO	52	0
16 TO	17	52 TO	55	0
17 TO	20	55 TO	65	0
20 TO	22	65 TO	72	0
22 TO	24	72 TO	78	0
24 TO	26	78 TO	85	0
26 TO	28	85 TO	91	0
28 TO	30	91 TO	98	0
30 TO	32	98 TO	104	0
32 TO	39	104 TO	127	0
39 TO	45	127 TO	147	0
45 TO	55	147 TO	180	0
55 TO	71	180 TO	232	0
71 TO	100	232 TO	328	0
OVER	100	OVER	328	1

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	0
1.2 TO 1.3	0
1.3 TO 1.4	0
1.4 TO 1.5	0
1.5 TO 1.6	0
1.6 TO 1.7	0
1.7 TO 1.8	0
1.8 TO 1.9	0
1.9 TO 2.0	0
2.0 TO 2.4	1
2.4 TO 2.6	0
2.6 TO 2.8	0
2.8 TO 3.0	0
3.0 TO 3.5	0
3.5 TO 4.0	0
4.0 TO 4.5	0
OVER 4.5	0

TABLE 10 (Cont'd)

DISTRIBUTION OF RECOGNIZED HOT SPOT

(Threshold = Ave. + 3.5 σ
9.0 - 11.4 μm)

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	0
10.0	TO	15.0	0
15.0	TO	20.0	0
20.0	TO	25.0	0
25.0	TO	30.0	0
30.0	TO	35.0	0
35.0	TO	40.0	0
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	0
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	1

TOTAL NUMBER OF HOT SPOT = 1

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	0
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	0
20	TO	22	65	TO	72	0
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	0
28	TO	30	91	TO	98	0
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	0
39	TO	45	127	TO	147	0
45	TO	55	147	TO	180	0
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	0
OVER		100	OVER		328	1

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	0
1.2	TO	1.3	0
1.3	TO	1.4	0
1.4	TO	1.5	0
1.5	TO	1.6	0
1.6	TO	1.7	0
1.7	TO	1.8	0
1.8	TO	1.9	0
1.9	TO	2.0	0
2.0	TO	2.4	1
2.4	TO	2.6	0
2.6	TO	2.8	0
2.8	TO	3.0	0
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	0

TABLE 10 (Concluded)

(Threshold = Ave. + 4.0 σ
9.0 - 11.4 μm)

DISTRIBUTION OF RECOGNIZED HOT SPOT

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	0
10.0	TO	15.0	0
15.0	TO	20.0	0
20.0	TO	25.0	0
25.0	TO	30.0	0
30.0	TO	35.0	0
35.0	TO	40.0	0
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	0
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	1

TOTAL NUMBER OF HOT SPOT = 1

BY PERIMETER

METERS	FEET	FREQUENCY
0 TO 7	0 TO 22	0
7 TO 10	22 TO 32	0
10 TO 12	32 TO 39	0
12 TO 14	39 TO 45	0
14 TO 16	45 TO 52	0
16 TO 17	52 TO 55	0
17 TO 20	55 TO 65	0
20 TO 22	65 TO 72	0
22 TO 24	72 TO 78	0
24 TO 26	78 TO 85	0
26 TO 28	85 TO 91	0
28 TO 30	91 TO 98	0
30 TO 32	98 TO 104	0
32 TO 39	104 TO 127	0
39 TO 45	127 TO 147	0
45 TO 55	147 TO 180	0
55 TO 71	180 TO 232	0
71 TO 100	232 TO 328	0
OVER 100	OVER 328	1

BY SHAPE

SHAPE FACTOR	FREQUENCY
0.0 TO 1.0	0
1.0 TO 1.1	0
1.1 TO 1.2	0
1.2 TO 1.3	0
1.3 TO 1.4	0
1.4 TO 1.5	0
1.5 TO 1.6	0
1.6 TO 1.7	0
1.7 TO 1.8	0
1.8 TO 1.9	0
1.9 TO 2.0	0
2.0 TO 2.4	1
2.4 TO 2.6	0
2.6 TO 2.8	0
2.8 TO 3.0	0
3.0 TO 3.5	0
3.5 TO 4.0	0
4.0 TO 4.5	0
OVER 4.5	0

TABLE 11

HUME2 - Cold Water Regions
AREA DISTRIBUTIONS

(Threshold = -2.0 σ
9.0 - 11.4 μm)

DISTRIBUTION OF RECOGNIZED COLDSPOT

BY AREA

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	0
10.0	TO	15.0	0
15.0	TO	20.0	0
20.0	TO	25.0	0
25.0	TO	30.0	0
30.0	TO	35.0	1
35.0	TO	40.0	0
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	0
75.0	TO	100.0	0
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	0

TOTAL NUMBER OF COLDSPOT = 1

2 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	0
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	0
20	TO	22	65	TO	72	0
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	0
28	TO	30	91	TO	98	0
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	1
39	TO	45	127	TO	147	0
45	TO	55	147	TO	180	0
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	0
OVER		100	OVER		328	0

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	0
1.2	TO	1.3	0
1.3	TO	1.4	0
1.4	TO	1.5	0
1.5	TO	1.6	0
1.6	TO	1.7	1
1.7	TO	1.8	0
1.8	TO	1.9	0
1.9	TO	2.0	0
2.0	TO	2.4	0
2.4	TO	2.6	0
2.6	TO	2.8	0
2.8	TO	3.0	0
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	0

TABLE 11 (Cont'd)

DISTRIBUTION OF RECOGNIZED COLDSPOT

BY AREA

(Threshold = -1.5 σ
9.0 - 11.4 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	0
10.0	TO	15.0	2
15.0	TO	20.0	0
20.0	TO	25.0	1
25.0	TO	30.0	0
30.0	TO	35.0	0
35.0	TO	40.0	0
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	0
75.0	TO	100.0	1
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	0

TOTAL NUMBER OF COLDSPOT = 4

7 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	0
14	TO	16	45	TO	52	0
16	TO	17	52	TO	55	0
17	TO	20	55	TO	65	2
20	TO	22	65	TO	72	0
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	0
26	TO	28	85	TO	91	1
28	TO	30	91	TO	98	0
30	TO	32	98	TO	104	0
32	TO	39	104	TO	127	0
39	TO	45	127	TO	147	0
45	TO	55	147	TO	180	0
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	1
OVER		100	OVER		328	0

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	0
1.2	TO	1.3	0
1.3	TO	1.4	1
1.4	TO	1.5	0
1.5	TO	1.6	2
1.6	TO	1.7	0
1.7	TO	1.8	0
1.8	TO	1.9	0
1.9	TO	2.0	0
2.0	TO	2.4	0
2.4	TO	2.6	1
2.6	TO	2.8	0
2.8	TO	3.0	0
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	0

TABLE 11 (Cont'd)

DISTRIBUTION OF RECOGNIZED COLDSPOT

BY AREA

(Threshold = -1.0 σ
9.0 - 11.4 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	9
10.0	TO	15.0	3
15.0	TO	20.0	1
20.0	TO	25.0	2
25.0	TO	30.0	0
30.0	TO	35.0	1
35.0	TO	40.0	0
40.0	TO	45.0	0
45.0	TO	50.0	0
50.0	TO	75.0	0
75.0	TO	100.0	1
100.0	TO	150.0	0
150.0	TO	200.0	0
200.0	TO	250.0	0
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	0
	OVER	500.0	1

TOTAL NUMBER OF COLDSPOT = 18

93 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	3
14	TO	16	45	TO	52	3
16	TO	17	52	TO	55	3
17	TO	20	55	TO	65	2
20	TO	22	65	TO	72	1
22	TO	24	72	TO	78	0
24	TO	26	78	TO	85	1
26	TO	28	85	TO	91	1
28	TO	30	91	TO	98	0
30	TO	32	98	TO	104	1
32	TO	39	104	TO	127	0
39	TO	45	127	TO	147	0
45	TO	55	147	TO	180	1
55	TO	71	180	TO	232	0
71	TO	100	232	TO	328	1
OVER		100	OVER		328	1

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	3
1.2	TO	1.3	1
1.3	TO	1.4	2
1.4	TO	1.5	1
1.5	TO	1.6	3
1.6	TO	1.7	1
1.7	TO	1.8	3
1.8	TO	1.9	0
1.9	TO	2.0	1
2.0	TO	2.4	1
2.4	TO	2.6	0
2.6	TO	2.8	0
2.8	TO	3.0	1
3.0	TO	3.5	0
3.5	TO	4.0	0
4.0	TO	4.5	0
	OVER	4.5	1

TABLE 11 (Concluded)

DISTRIBUTION OF RECOGNIZED COLDSPOT

BY AREA

(Threshold = −0.5 σ
9.0 − 11.4 μm)

SQUARE METERS			FREQUENCY
0.0	TO	5.0	0
5.0	TO	10.0	38
10.0	TO	15.0	24
15.0	TO	20.0	19
20.0	TO	25.0	8
25.0	TO	30.0	3
30.0	TO	35.0	4
35.0	TO	40.0	0
40.0	TO	45.0	4
45.0	TO	50.0	1
50.0	TO	75.0	9
75.0	TO	100.0	4
100.0	TO	150.0	2
150.0	TO	200.0	0
200.0	TO	250.0	3
250.0	TO	300.0	0
300.0	TO	400.0	0
400.0	TO	500.0	1
	OVER	500.0	10

TOTAL NUMBER OF COLDSPOT = 130

345 FEATURES WITH AREAS LESS THAN 8.00 SQ. METERS WERE ALSO RECOGNIZED

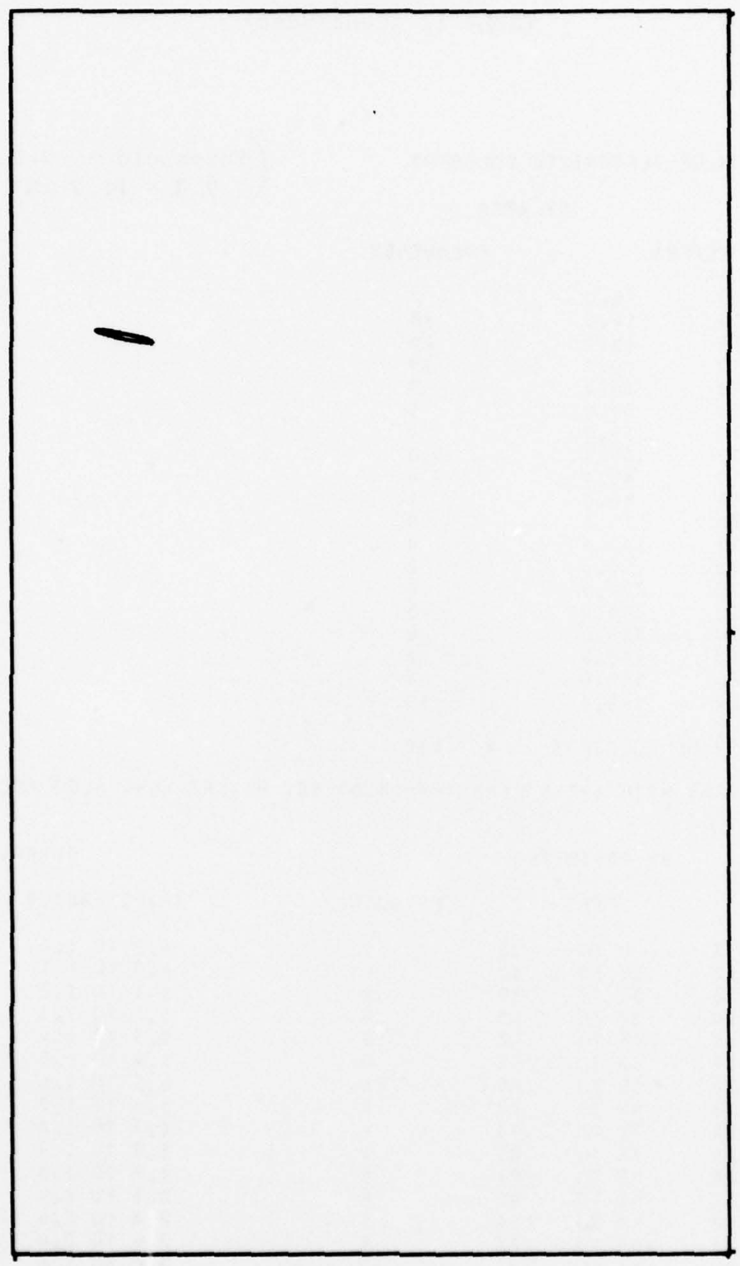
BY PERIMETER

METERS			FEET			FREQUENCY
0	TO	7	0	TO	22	0
7	TO	10	22	TO	32	0
10	TO	12	32	TO	39	0
12	TO	14	39	TO	45	8
14	TO	16	45	TO	52	16
16	TO	17	52	TO	55	5
17	TO	20	55	TO	65	28
20	TO	22	65	TO	72	8
22	TO	24	72	TO	78	4
24	TO	26	78	TO	85	5
26	TO	28	85	TO	91	6
28	TO	30	91	TO	98	6
30	TO	32	98	TO	104	3
32	TO	39	104	TO	127	3
39	TO	45	127	TO	147	4
45	TO	55	147	TO	180	6
55	TO	71	180	TO	232	7
71	TO	100	232	TO	328	4
OVER		100	OVER		328	17

BY SHAPE

SHAPE FACTOR			FREQUENCY
0.0	TO	1.0	0
1.0	TO	1.1	0
1.1	TO	1.2	9
1.2	TO	1.3	5
1.3	TO	1.4	28
1.4	TO	1.5	4
1.5	TO	1.6	17
1.6	TO	1.7	5
1.7	TO	1.8	11
1.8	TO	1.9	4
1.9	TO	2.0	7
2.0	TO	2.4	14
2.4	TO	2.6	4
2.6	TO	2.8	2
2.8	TO	3.0	1
3.0	TO	3.5	3
3.5	TO	4.0	2
4.0	TO	4.5	3
OVER		4.5	11

Scanline
#1351



#1550

Area: HUM2 (Open Water, Cold Spots)

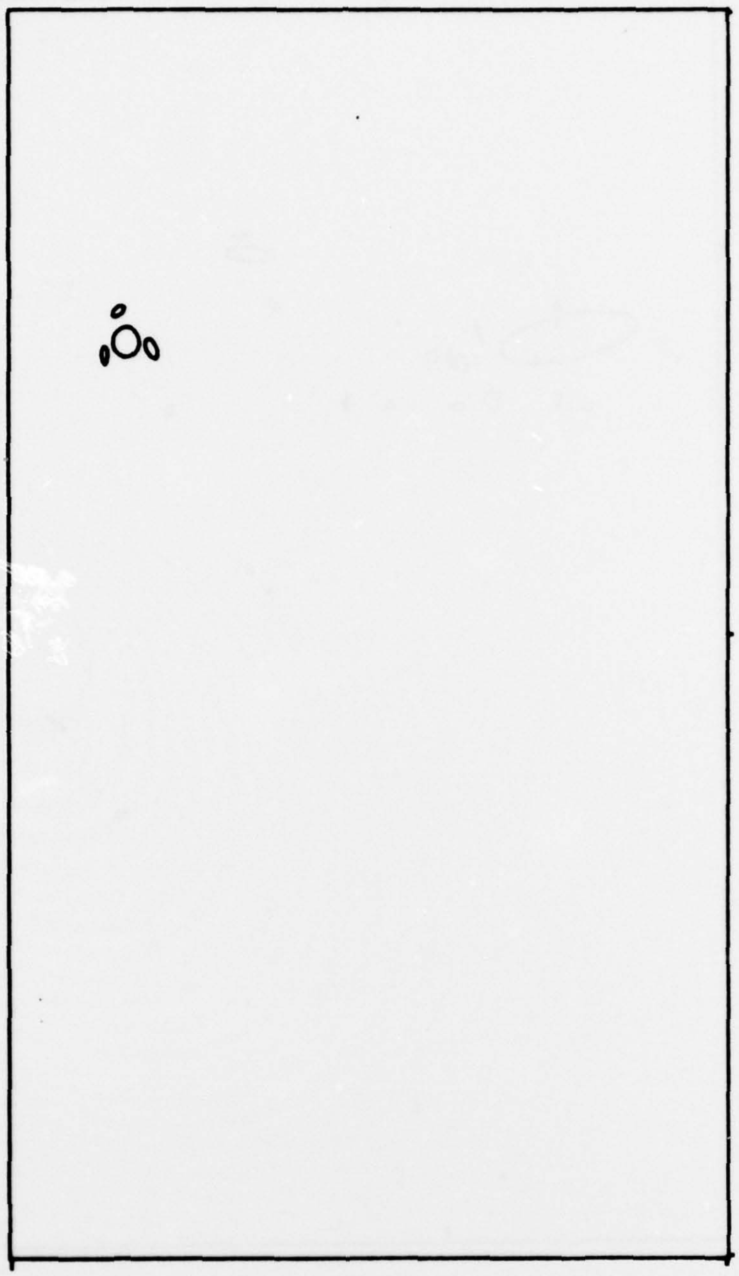
Temperature Threshold

= - 2.00 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 17a. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline
#1351



#1550

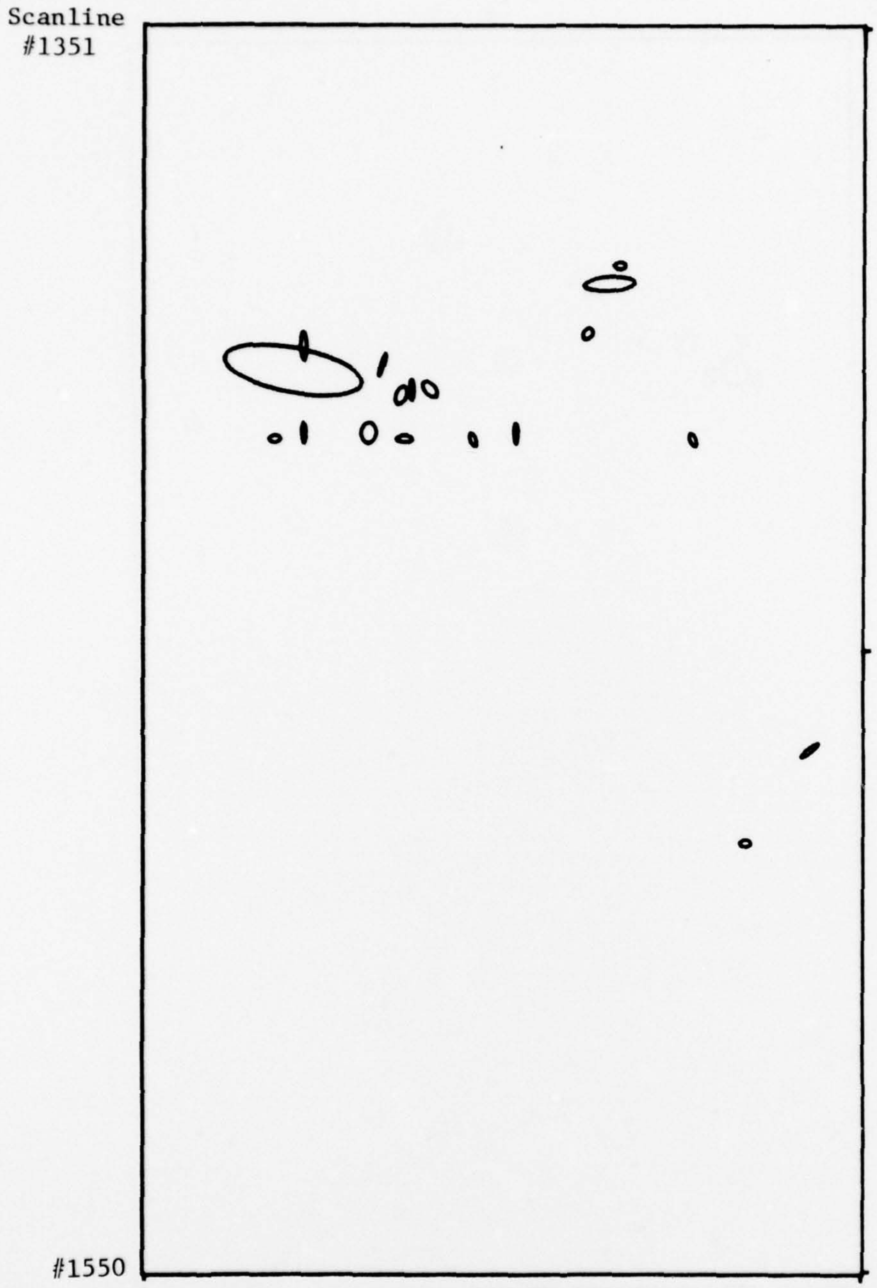
Area: HUM2 (Open Water, Cold Spots)

Temperature Threshold

= - 1.50 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 17b. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME



Area: HUM2 (Open Water, Cold Spots)

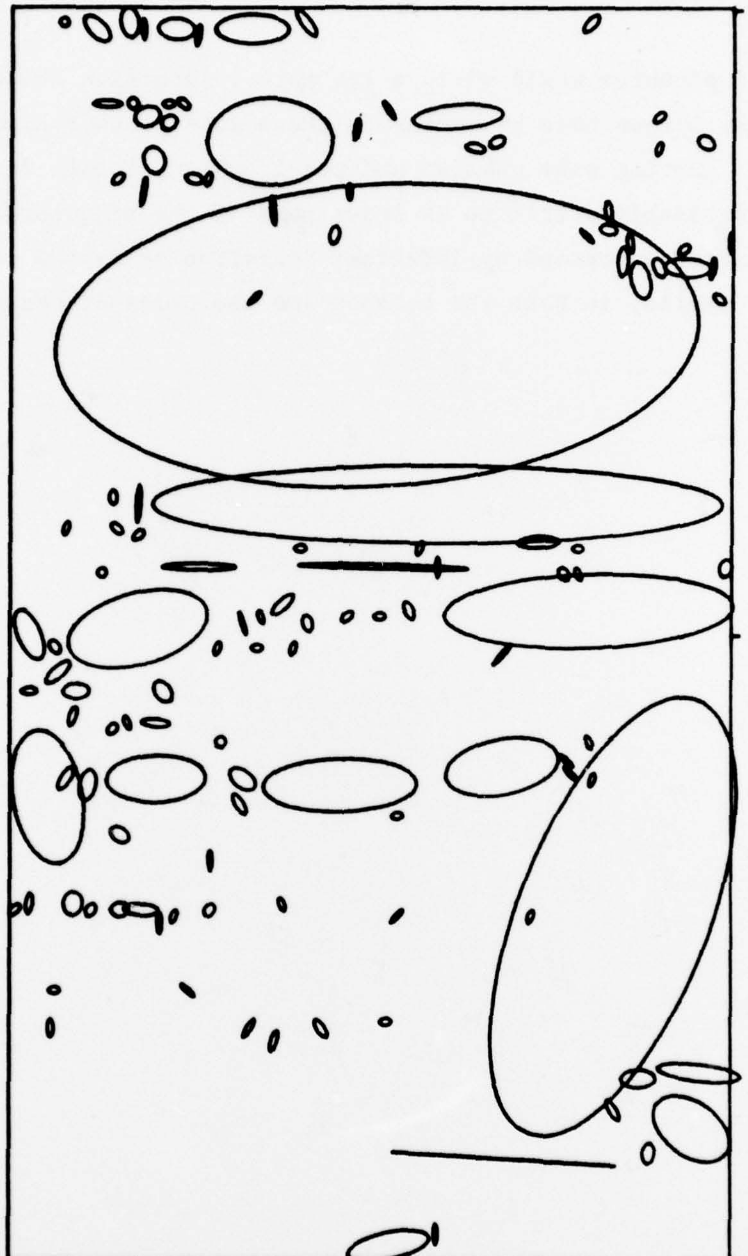
Temperature Threshold

= - 1.00 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 17c. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Scanline
#1351



#1550

Area: HUM2 (Open Water, Cold Spots)

Temperature Threshold

= - 0.50 σ

Wavelength = 9.0 - 11.4 μm

FIGURE 17d. EQUIVALENT ELLIPTICAL AREAS FOR PORT HUENEME

Time-resolved pictures would yield a lot more information about the singularities, but we have no access in these data to that kind of information. Barring some unknown and peculiar temperature distribution, one could conceivably attribute at least some of the singularities to emissivity variation caused by localized pollution or by the geometry of the water swells, in both the hotspot and the coldspot cases.

APPENDIX A

DESCRIPTIVE MATERIAL ON IMAGERY AREAS

As explained in greater detail in Reference 1, each ellipse is generated to represent a feature consisting of all contiguous pixels which occur about the preset threshold signal designated in the captions of the ellipse figures. The area of the ellipse is equal to the area of the thresholded feature, and the perimeter of the ellipse is the same as the perimeter of the feature. The shape of the ellipse is constructed to meet these two criteria. Thus, the shape factor is given by:

$$\text{shape factor} = \frac{\text{perimeter}/2\pi}{\sqrt{\text{area}/\pi}}$$

For a circular area, the shape factor is, therefore, unity.

In Tables 7, 8, 10, and 11, the distributions of ellipses are tabulated in terms of area, perimeter, and shape factor. It is possible also from the statistics generated in the computation to pinpoint the exact centroids of the ellipses and their spatial orientations. These latter data are not included in this report.

In the ellipse figures, only the digital line numbers in the scenery are shown. For the purpose of picturing the sizes given in Table 1, the sizes corresponding to the areas in Figures 11, 12, 16, and 17 are shown in Figure A-1.

In Figure A-2, we have chosen (reproduced) a sample thermal image from Figure 3b and overlaid a transparency made up of Figure 12ℓ to show the correspondence between the thermal image and the ellipse representative of the same scenery. It should be observed that, because the ellipses are made up of all contiguous areas above a given threshold (1.0σ above the average in the demonstration), some ellipses do not correspond noticeably with obvious features in the photographic imagery.

[1] R. Spellicy, J. Beard, and J. R. Maxwell, Statistical Analysis of Terrain Background Measurements Data, Report 120500-12-F, ERIM March 1977.

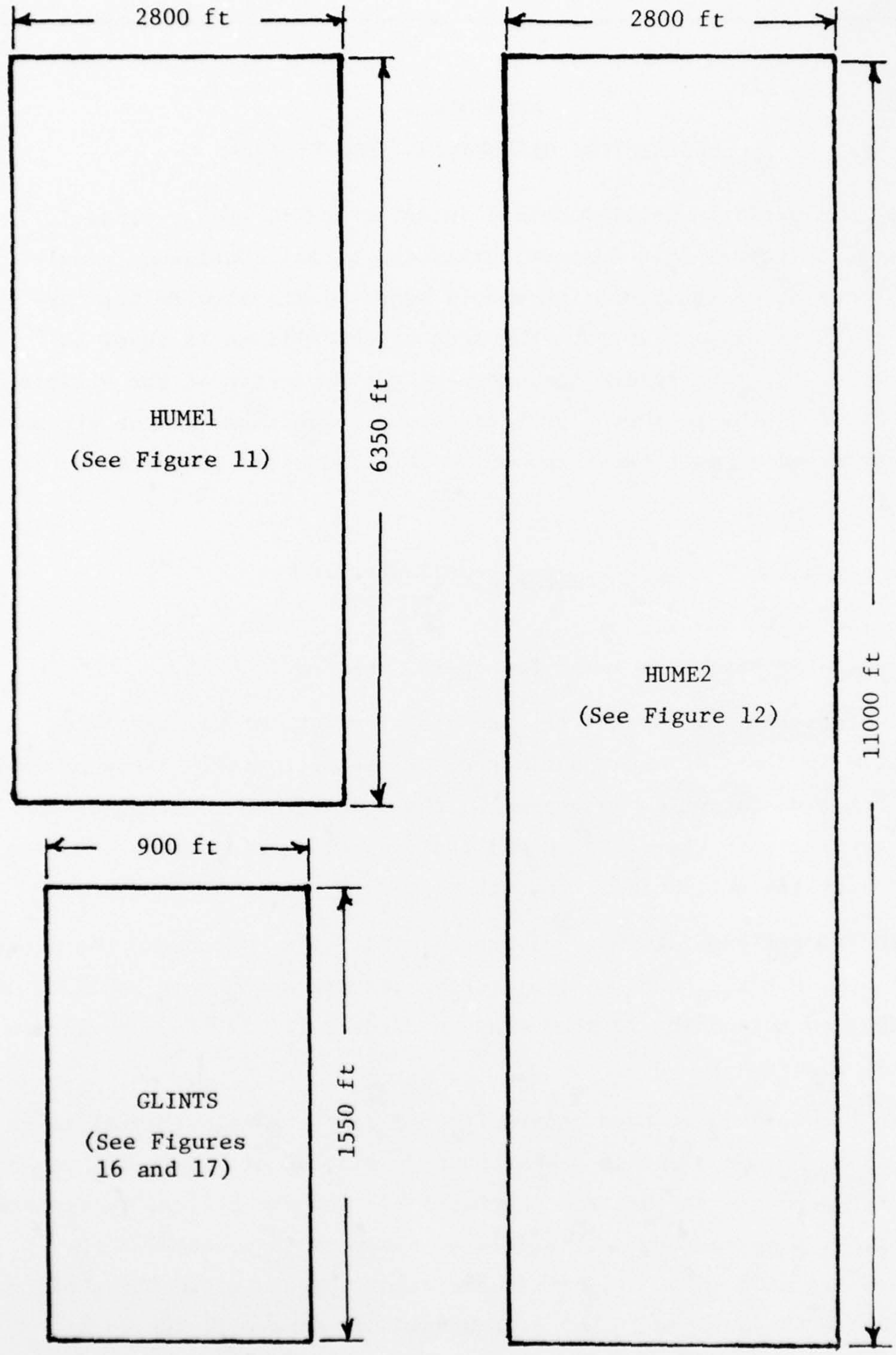


FIGURE A-1. ELLIPSE SCENERY, AREA SIZES

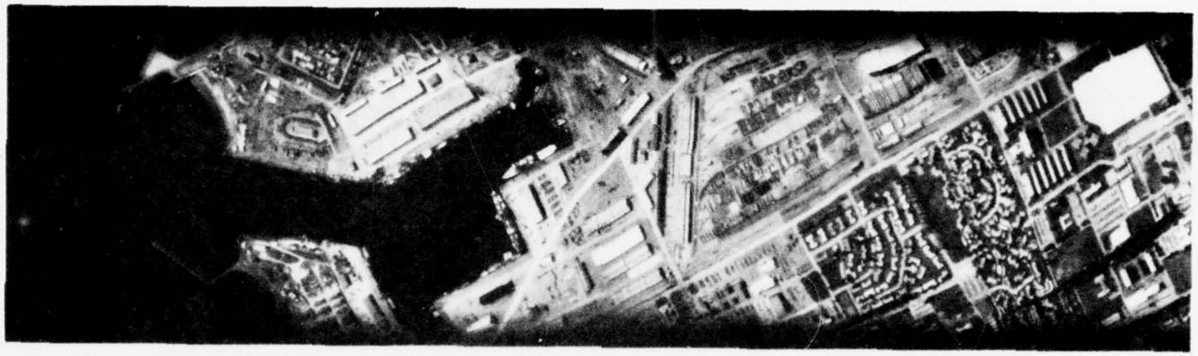


FIGURE A-2. ELLIPSE MATCH WITH IMAGERY

APPENDIX B

ATMOSPHERIC CONSIDERATIONS FOR THE PORT HUENEME DATA

Close examination of the apparent temperature histograms in Figures 6 through 10 for the 9.0-11.4 μm and 4.5-5.5 μm spectral bands reveals a large divergence in measured apparent temperatures between these two bands--a divergence which seems to get greater as the temperatures go higher. While either calibration errors or spectral differences in target emissivity could account for this, it is felt that the more likely source of the temperature divergence is the relative effect of the intervening atmosphere on these two bands. This is based in part on the fact that (1) the data were checked and rechecked for possible calibration errors and none were found*, and (2) the large number of pixels used in the histograms represents a large number of ground objects--a fact which would minimize gross target emissivity differences. Add to all of this the fact that atmospheric absorption in the 4.7-5.5 μm band is very strong (due to the presence of water vapor) while there is little absorption at all in the 9.0-11.4 μm region and it is apparent why the atmosphere is the likely cause of the observed differences.

To verify this, an atmospheric band model (ERIM's AGGREGATE) was used to generate spectral transmission and path radiance values in the two regions of interest for an atmosphere typical of Port Hueneme's latitude and the time of year. The most important environmental parameter to be inputted to the model was the relative humidity because of the strong water absorption in the mid-IR region. Since almost all of the data collected was within one mile of the Pacific Ocean, a relative humidity equal to 85% was somewhat arbitrarily chosen as representative of the conditions at the time of the overflights. All other inputted parameters were either obtained from local ground truth or from U.S. Standard Atmosphere Tables.

*Normal calibration procedure is not to include any atmospheric considerations.

The spectral transmission and path radiance data obtained from the model (altitude=1750 ft, view angle=22° from nadir) were then integrated over the spectral response region of the detector/filter combination to find the average band values. The results of these integrations for the mid- and far-IR regions are shown below:

4.5-5.5 μm region: $\bar{\tau} = .52$

$\bar{L}_{path} = .686 \times 10^{-4}$ μw/cm^2/sr

9.0-11.4 μm region: $\bar{\tau} = .86$

$\bar{L}_{path} = .217 \times 10^{-3}$ μw/cm^2/sr

As was anticipated, the mid-IR band shows considerably more absorption than the far-IR band. But the question remains as to whether these above atmospheric values would in fact cause the magnitude of the temperature divergence observed in the data. This is discussed next.

The basic relationship which describes the effect of the atmosphere on the apparent ground temperatures measured at a scanner's aperture is given by Equation B-1.

$$L_{scanner}(\lambda, T_s) = \bar{\tau} L_{ground}(\lambda, T_G) + L_{path} \qquad \text{B-1}$$

where $L_{ground}(\lambda, T_G)$ = band radiance from ground target at temperature T_G,

$L_{scanner}(\lambda, T_s)$ = band radiance from ground target at scanner aperture at apparent temperature T_s,

$\bar{\tau}$ = band transmission of atmosphere,

L_{path} = path radiance in band.

To verify that the collected data set at Port Hueneme did in fact obey the kind of relationship indicated in Equation B-1, various ground scene objects with apparent temperatures at the scanner's entrance aperture of T_A in the 4.5-5.5 μm band and T_B in the 9.0-11.4 μm band were tabulated as shown in Table B-1. Since the apparent temperature T_B was obtained essentially

through a clear atmosphere, we can assume that T_B represents the ground temperature T_G. Hence, by calculating the 4.5-5.5 band radiances corresponding to T_A and T_B in Table B-1 and equating T_A to T_S and T_B to T_G in Equation B-1, we can solve Equation B-1 for L_{path} and τ using the technique of linear regression. Doing this, we get a measured transmission and path radiance in the mid-IR band of:

4.5-5.5 μm region: $\tau = .48$

$L_{path} = .736 \times 10^{-4}$ μm/cm/sr

$r = .991$ (coefficient of determination)

These above measured atmospheric parameters compare very favorably with the results estimated from the atmospheric band model which would indicate that the nominal atmosphere chosen for the model could indeed cause the temperature divergence observed in the data.

TABLE B-1

APPARENT TEMPERATURE AND RADIANCE VALUES FOR TWO SPECTRAL BANDS

Area		T_A	T_B	$L_{scanner}$	L_{ground}
HUM1	Area #1	287.8	288.5	1.43	1.46
		294.0	300.0	1.76	2.15
		298.0	307.0	2.02	2.68
		303.0	316.0	2.36	3.52
	Area #2	288.0	288.5	1.43	1.46
		298.0	305.0	2.02	2.51
		303.8	315.0	2.42	3.42
		306.4	319.5	2.63	3.90
		310.0	325.0	2.94	4.55
	Total Scene	287.5	288.9	1.41	1.52
		289.8	292.5	1.52	1.68
		297.8	305.4	2.01	2.55
HUM2	Area #2	289.5	291.5	1.51	1.62
		299.0	305.5	2.09	2.55
		306.5	320.4	2.64	4.01
		308.0	323.5	2.77	4.36
	Total Scene	286.5	286.5	1.36	1.36

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